Safety Evaluation Report

Related to the License Renewal of Cooper Nuclear Station

Docket No. 50-298

Nebraska Public Power District

United States Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

April 2010

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ABSTRACT

This safety evaluation report (SER) documents the technical review of the Cooper Nuclear Station (CNS) license renewal application (LRA) by the U.S. Nuclear Regulatory Commission (NRC) staff (the staff). By letter dated September 24, 2008, Nebraska Public Power District (NPPD 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." NPPD requests renewal of the CNS operating license (Facility Operating License Number DPR-46) for a period of 20 years beyond the current expiration at midnight January 18, 2014. CNS is located in Nemaha County, Nebraska, on the west bank of the Missouri River at river mile 532.5. The NRC issued the construction permit for CNS in June 1968 and operating license on January 18, 1974. CNS is a boiling water reactor (BWR) design. General Electric supplied the nuclear steam supply system and Burns and Roe originally designed and constructed the balance of the plant. The CNS licensed power output is 2,419 megawatt thermal (MWt) with a gross electrical output of approximately 830 megawatt electric (MWe). This SER presents the status of the staff's review of information submitted through March 29, 2010, the cutoff date for consideration in the SER. The staff identified open items that must be resolved before any final determination can be made on the LRA. SER Section 1.5 summarizes these items. The staff will present its final conclusion on the LRA review in an update to this SER.

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TABLES

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ABBREVIATIONS AND ACRONYMS

¼ T	one-fourth of the way through the vessel wall measured from the internal surface of the vessel
AC	auxiliary condensate
ACD	auxiliary condensate drain
ACI	American Concrete Institute
ACRS	Advisory Committee on Reactor Safeguards
ACSR	aluminum conductor steel reinforced
ADS	automatic depressurization system
AEA	Atomic Energy Act of 1954
AEM	aging effect/mechanism
AERM	aging effects requiring management
Al	aluminum
ALT	alternate leakage treatment
AMP	aging management program
AMR	aging management review
ANSI	American National Standards Institute
APCSB	Auxiliary and Power Conversion Systems Branch
AR	air removal
ARB	augmented radwaste building
ARI	alternate rod insertion
ART	adjusted reference temperature
AS	auxiliary steam
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATWS	anticipated transient without scram
AWG	American wire gauge
B&PV	Boiler and Pressure Vessel
BTP	Branch Technical Position

BWR	boiling-water reactor
BWRVIP	Boiling Water Reactor Vessel and Internals Program
CAP	Corrective Action Program
CASS	cast austenitic stainless steel
CCW	closed cooling water
CD	condensate drain
CE	Combustion Engineering, Inc.
CEOG	Combustion Engineering Owners Group
CF	chemistry factors; condensate filter demineralizer
CFR	Code of Federal Regulations
CI	confirmatory item
CII	containment inservice inspection
CLB	current licensing basis
CM	condensate makeup
CNS	Cooper Nuclear Station
CO_2	carbon dioxide
CR	condition report
CRD	control rod drive
CRDM	control rod drive mechanism
CRE	control room envelope
CREF	control room emergency filter
CS	core spray
CST	condensate storage tank
Cu	copper
CUF	cumulative usage factor
CVN	Charpy V-notch
CW	circulating water
CWL	chemistry warning limit

DBA	design basis accident
DBE	design basis event
DC	direct current
DCD	design criteria document
DG	diesel generator
DGFO	diesel generator fuel oil
DGJW	diesel generator jacket water
DGLO	diesel generator lube oil
DGSA	diesel generator starting air
ΔP	differential pressure
DO	dissolved oxygen
DW	demineralized water
DWST	demineralized water storage tank
EAC	equipment area cooling
EAF	environmental-assisted fatiguing
ECCS	emergency core cooling system
ECP	electrochemical potential
ECST	emergency condensate storage tank
EDI	electrol deionization
EFPY	effective full-power years
EH	electrohydraulic
EIC	electrical and instrumentation and control
EMA	equivalent margin analysis
EN	shelter or protection
EPRI	Electric Power Research Institute
EQ	environmental qualification
EQUIP	environmental qualification improvement project
ERP	elevated release point
ES	extraction steam
ESF	engineered safety feature

ESST	emergency station service transformer ext external
EVT-1	enhanced visual inspection for nuclear power plants
FDN	floor drains, non-radioactive
F_{en}	environmental correction factor(s) – metal fatique
FERC	Federal Energy Regulatory Commission
FF	fluence factor
FHA	fire hazard analysis
FLB	flood barrier
FLT	filtration
FLV	floodable volume
FMP	Fatigue Monitoring Program
FPC	fuel pool cooling and cleanup
FSAR	Final Safety Analysis Report
ft-lb	foot-pound
FW	feedwater
g/m^3	grams per cubic meter
GALL	generic aging lessons learned
GDC	general design criteria
GE	General Electric Co.
GEIS	generic environmental impact statement
GL	generic letter
GSI	generic safety issue
HCU	hydraulic control unit
HELB	high-energy line break
HEPA	high-efficiency particulate air
HPCI	high-pressure coolant injection
HV	heating and ventilation
HVAC	heating, ventilation, and air conditioning

HWC	hydrogen water chemistry
IA	instrument air
IASCC	irradiation assisted stress corrosion cracking
ID	inside diameter
IGSCC	intergranular stress corrosion cracking
INPO	Institute of Nuclear Power Operations
IPA	integrated plant assessment
ISG	interim staff guidance
ISI	inservice inspection
ISP	Integrated Surveillance Program
K_e	elastic-plastic correction factor
ksi	thousands of pounds per square inch
kV	kilovolt
LO	lube oil
LOGT	turbine lube oil-instruments
LOCA	loss of coolant accident
LOOP	loss of offsite power
LPCI	low-pressure coolant injection
LPRM	local power range monitor
LRA	license renewal application
LWR	light-water reactor
MB	missile barrier
MC	main condensate
MCM	thousand circular mils
MDMT	minimum design metal temperatures
MEAP	material, environment, and aging management program
MeV	million electron volts
MG	motor-generator

Mg/l	milligram per liter
MIC	microbiologically influenced corrosion
MO	Missouri
MoS_2	molybdenum disulfide
MPF	multi-purpose facility
MPR	mechanical pressure regulator
MS	main steam
MSIV	main steam isolation valve
MUR	measurement uncertainty recapture
MWe	megawatt electric
MWt	megawatt thermal
N_2	nitrogen
$NaNO_2$	sodium nitrate
NB	nuclear boiler
NBI	nuclear boiler instrumentation
n/cm^2	neutrons per square centimeter
NDE	nondestructive examination
NE	Nebraska
NEI	Nuclear Energy Institute
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
NM	neutron monitoring
NMCA	noble metal chemical addition
NMT	neutron monitoring–TIP
NPPD	Nebraska Public Power District
NPS	nominal pipe size
NRC	Nuclear Regulatory Commission
NSAC	Nuclear Safety Analysis Center
NSSS	nuclear steam supply system
NUMARC	Nuclear Management and Resources Council

NUREG/CR	NUREG contractor report
NWC	normal water chemistry
OBE	operating basis earthquake
OE	operating experience
OG	off-gas
OI	open item
OWC	optimum water chemistry
OWCGG	optimum water chemistry gas generator
P&ID	piping and instrumentation diagram
PAS	post-accident sample
PC	primary containment
pH	potential of hydrogen
ppb	parts per billion
ppm	parts per million
psf	pounds per square feet
psig	pound force per square inch gauge
PSPM	periodic surveillance and preventive maintenance
P-T	pressure-temperature
PTS	pressurized thermal shock
PUA	plant-unique analysis
PVC	polyvinyl chloride
PW	potable water
PWR	pressurized water reactor
QA	quality assurance
QAP	Quality Assurance Program
RAI	request for additional information
RAMA	Radiation Analysis Modeling Application
RCIC	reactor core isolation cooling

RCPB	reactor coolant pressure boundary
RCS	reactor coolant system
REC	reactor equipment cooling
RF	reactor feedwater
RFLO	reactor feedwater pump and turbine lube oil
RFO	refueling outage
RG	Regulatory Guide
RHR	residual heat removal
RHRSW	residual heat removal service water
RI-ISI	risk informed–inservice inspection
RMP	radiation monitoring–process
RMV	radiation monitoring–vent
RO	reverse osmosis
RPS	reactor protection system
RPV	reactor pressure vessel (synonymous with reactor vessel)
RR	reactor recirculation
RRLO	reactor recirculation–lube oil
RTNDT	reference temperature (nil-ductility transition)
RV	reactor vessel
RVDL	relief valve discharge line
RVI	reactor vessel internal
RVID	Reactor Vessel Integrity Database
RW	radioactive waste
RWCU	reactor water cleanup
SA	service air
SAMA	severe accident mitigation alternatives
S&PC	steam and power conversion
SBNI	standby nitrogen injection
SBO	station blackout
SC	structure and component

SCBA	self-contained breathing apparatus
SCC	stress-corrosion cracking
scfm	standard cubic feet per minute
SCRAM	safety control rod axe man – emergency shutdown
SE, SER	safety evaluation, safety evaluation report
SGT	standby gas treatment
SGTS	standby gas treatment system
SJAE	steam jet air ejectors
SLC	standby liquid control
SNS	support for Criterion (a)(2) equipment
SRE	support for Criterion (a)(3) equipment
SRP-LR	standard review plan–license renewal
SRSS	square root of the sum of the squares
SRV, S/RV	safety/relief valve
S/RVDL	safety/relief valve discharge lines
SSC	system, structure, and component
SSR	support for Criterion (a)(1) equipment
SSST	station startup system transformers
SW	service water
TAP	torus-attached piping
TEC	turbine equipment cooling
TG	turbine generator
TGF	turbine generator EH fluid
TIP	traversing incore probe
TLAA	time-limited aging analysis
TPO	thermal power optimization
TRM	technical requirements manual
TSE	tools and servicing equipment
ULSD	ultra-low-sulfur diesel

USACE	U.S. Army Corps of Engineers
USAR	updated safety analysis report (this is the same as updated final safety analysis report or UFSAR)
USAS	United States of America Standards
USE	upper-shelf energy
UT	ultrasonic testing
VFLD	vessel flange leak detection
VT	visual testing
Zn	zinc

SECTION 1

INTRODUCTION AND GENERAL DISCUSSION

1.1 Introduction

This document is a safety evaluation report (SER) on the license renewal application (LRA) for Cooper Nuclear Station (CNS) as filed by the Nebraska Public Power District (NPPD or the applicant). By letter dated September 24, 2008, NPPD submitted its application to the U.S. Nuclear Regulatory Commission (NRC) for renewal of the CNS 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 Tam Tran. Mr. Tran may be contacted by telephone at 301-415-3617 or by electronic mail at Tam.Tran@nrc.gov. Alternatively, written correspondence may be sent to the following address:

Division of License Renewal
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
Attention: Tam Tran, Mail Stop O11-E1

In its September 24, 2008, submission letter, the applicant requested renewal of the operating license, issued under Section 104b (Operating License No. DPR-46) of the Atomic Energy Act (AEA) of 1954, as amended, for CNS for a period of 20 years beyond the current expiration at midnight January 18, 2014. CNS is located in Nemaha County, Nebraska, on the west bank of the Missouri River at river mile 532.5. The NRC issued the construction permit for CNS in June 1968 and the operating license for CNS on January 18, 1974. CNS is a General Electric (GE) Mark I boiling water reactor (BWR) design. GE supplied the nuclear steam supply system and Burns and Roe originally designed and constructed the balance of the plant. The licensed power output of CNS is 2,419 megawatt thermal (MWt) with a gross electrical output of approximately 830 megawatt electric (MWe). The updated safety analysis report (USAR) shows details of the plant and the site.

The license renewal process consists of two concurrent reviews, a technical review of safety issues and an environmental review. The NRC regulations in 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," 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 CNS license renewal is based on the applicant's LRA and on its responses to the staff's requests for additional information (RAIs). The applicant supplemented the LRA and provided clarifications through its responses to the staff's RAIs in audits, meetings, and docketed correspondence. The public may view the LRA and all pertinent information and materials, including the USAR, at the NRC Public Document Room, located on the first floor of One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852-2738 (301-415-4737/800-397-4209). A copy of the LRA is also available to local residents near CNS, at the Auburn Memorial Library, 1810 Courthouse Avenue, Auburn, Nebraska 68305. In addition, the public may find the LRA, as well as materials related to the license renewal review, on the NRC Web site at http://www.nrc.gov.

This SER summarizes the results of the staff's safety review of the LRA and describes the technical details considered in evaluating the safety aspects of the unit's proposed operation for an additional 20 years beyond the term of the current operating license. The staff reviewed the LRA in accordance with NRC regulations and the guidance in NUREG-1800, Revision 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 application. SER Section 5 is reserved for the report of the Advisory Committee on Reactor Safeguards (ACRS). The conclusions of this SER are in Section 6.

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

In accordance with 10 CFR Part 51, the staff prepared a draft, plant-specific supplement to NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS)." This supplement discusses the environmental considerations for license renewal for CNS. The staff will issue a draft, plant-specific GEIS Supplement 41, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Cooper Nuclear Station, Unit 1, Draft Report for Comment," in 2010. The final, plant-specific GEIS Supplement 41, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Cooper Nuclear Station, Unit 1, Final Report," will be issued later in 2010.

1.2 License Renewal Background

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

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

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

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

1.2.1 Safety Review

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

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

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

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

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

In accordance with 10 CFR 54.21(d), the LRA is required to include a USAR supplement with a summary description of the applicant's programs and activities for managing aging effects and an evaluation of time-limited aging analyses (TLAAs) for the period of extended operation. License renewal also requires TLAA identification and updating. During the plant design phase, certain assumptions about the length of time the plant can operate are incorporated into design calculations for several plant SSCs. In accordance with 10 CFR 54.21(c)(1), the applicant must either show that these calculations will remain valid for the period of extended operation, project the analyses to the end of the period of extended operation, or demonstrate that the aging effects on these SSCs will be adequately managed for the period of extended operation.

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

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

1.2.2 Environmental Review

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

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 or not there was new and significant information not considered in the GEIS. As part of its scoping process, the staff held two public meetings on February 25, 2009, to identify plant-specific environmental issues. The public meetings were held at Brownville and Auburn, Nebraska. The draft, plant-specific GEIS Supplement 41 documents the results of the environmental review and makes a preliminary recommendation regarding the license renewal action. The staff planned to hold public meetings in Auburn, Nebraska, in April 2010 to discuss the draft, plant-specific GEIS Supplement 41. After considering comments on the draft, the staff will publish the final, plant-specific GEIS Supplement 41 in 2010.

1.3 Principal Review Matters

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

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

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

> The current indemnity agreement (No. B-57) for CNS 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 by Amendment No. 4, lists CNS operating license number DPR-46. The Applicant requests that any necessary conforming changes be made to specify the extension of the agreement until the expiration of the renewed CNS facility operating license sought in the application. In addition, should the license number change upon issuance of the renewed license, the Applicant 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 10 CFR 54.19(b) requirements have been met.

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

In accordance with 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 submits an LRA amendment identifying any CLB changes to the facility that affect the contents of the LRA, including the USAR supplement. The applicant scheduled to submit LRA updates, which summarize the CLB changes that have occurred during the staff's review of the LRA, on an annual basis. These submissions are in accordance with 10 CFR 54.21(b) requirements.

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

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

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

1.4 Interim Staff Guidance

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 applicable ISG as well as the SER section in which the staff addresses it.

Table 1.4-1 Interim Staff Guidance for the Safety Evaluation Report

ISG Issue (Approved ISG Number)	Purpose	SER Section
Changes to GALL Report AMP XI.E6, “Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements” (LR-ISG-2007-02)	To address the frequency of inspection of electrical cable connections not subject to 10 CFR 50.49 prior to the period of extended operation.	3.0.3.3.2
Plant-Specific Aging Management Program for Inaccessible Areas of Boiling Water Reactor Mark I Steel Containment Drywell Shell (LR-ISG-2006-01)	To address concerns related to corrosion of drywell shell in Mark I containments.	3.0.3.2.6

1.5 Summary of Open Items

As a result of its review of the LRA, including additional information submitted through March 29, 2010, the staff identified the following open items (OIs). An item is considered open if, in the staff’s evaluation, it does not meet all applicable regulatory requirements or the staff has not finished its review at the time of the issuance of this SER. The staff has assigned a unique identifying number to each OI.

OI 2.3.4.2-1: (SER Section 2.3.4.2 - Steam and Power Conversion Systems In-Scope for 10 CFR 54.4(a)(2))

LRA Section 2.3.4.2 describes the steam and power conversion systems within the scope of license renewal in accordance with 10 CFR 54.4(a)(2), which includes the condensate makeup system. During its review of the LRA, staff determined that the condensate storage tank (CST) 1A should have been included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The applicant has not agreed to this scoping issue. This is OI 2.3.4.2-1.

OI 3.0.3.1-1: (SER Section 3.0.3.1.11 - One-Time Inspection, Small Bore Piping Program)

LRA Section B.1.30 describes the new One-Time Inspection – Small Bore Piping Program, which the applicant claims to be consistent with GALL AMP XI.M35, “One-Time Inspection of ASME Code Class 1 Small Bore Piping.” During its review, the staff determined that small bore piping includes socket welds, and that, because of operating experience with failures of socket welds, a periodic inspection of such welds under a plant-specific program, consistent with GALL AMP XI.M35, would be appropriate at CNS for license renewal. The applicant has not agreed to include socket weld nor commit to a plant-specific program at CNS. This is OI 3.0.3.1-1.

OI 3.0.3.1.2-1: (SER Section 3.0.3.1.2 - Buried Piping and Tanks Inspection)

LRA Section B.1.3 describes the applicant’s new Buried Piping and Tanks Inspection Program as consistent with GALL AMP XI.M34, “Buried Piping and Tanks Inspection.” Using this program, the applicant proposes to manage the effects of corrosion in buried carbon steel, gray cast iron, and stainless steel components via a combination of external coatings and periodic inspections. During its review, the staff determined that it needs additional information to evaluate the impact of recent industry operating experience, regarding leakage from buried or underground piping, on the applicant’s Buried Piping and Tanks Inspection Program. The staff has communicated this need for further evaluation with the applicant and the issue remains as OI 3.0.3.1.2-1.

OI 3.0.3.2-1: (SER Section 3.0.3.2.6 - Containment Inservice Inspection Program)

In LRA Section B.1.10, the applicant credits its existing Containment ISI Program to be consistent, with enhancements, with GALL AMP XI.S1, “ASME Section XI, Subsection IWE,” in managing the loss of material and cracking for the primary containment and its integral attachments. During its review of the program’s operating experience, the staff concluded that the applicant has not demonstrated that the effects of the torus degradation will be adequately managed so that the intended function will be maintained for the period of extended operation in accordance with 10 CFR 54.21(a)3. This issue remains unresolved as OI 3.0.3.2-1.

1.6 Summary of Confirmatory Items

As a result of its review of the LRA, including additional information submitted through March 29, 2010, the staff identified the following confirmatory items (CIs). An item is considered confirmatory if the staff and the applicant have reached a satisfactory resolution but the applicant has not yet formally submitted the resolution. The staff has assigned a unique identifying number to each CI.

CI 4.3.3.2-1: (SER Section 4.3.3 - Effects of Reactor Water Environment on Fatigue Life)

Section 4.3.3 of the LRA describes the applicant's evaluation of the effects of the reactor coolant environment on the fatigue life of components. In the LRA and subsequent RAI response, the applicant indicated that its fatigue correction (F_{en}) factor for alloy 600 was calculated in accordance with the method described in NUREG/CR 6335. However, the staff noted that NUREG/CR-6909 contains later data and information that provide equations for determining a F_{en} factor that can result in more conservative value than the value calculated by the applicant. The staff requests that the applicant demonstrates adequate conservatism using the NUREG/CR 6335 methodology. This is CI 4.3.3.2-1.

1.7 Summary of Proposed License Conditions

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

The first license condition requires the applicant to include the USAR supplement, in accordance with 10 CFR 54.21(d), in the next USAR update, in accordance with 10 CFR 50.71(e), following the issuance of the renewed licenses. The applicant may make changes to the programs and activities described in the USAR supplement provided changes are evaluated in accordance with the criteria set forth in 10 CFR 50.59.

The second license condition requires future activities described in the USAR supplement to be completed prior to the period of extended operation and that the applicant notify the staff in writing when these activities are complete and can be verified by NRC inspection.

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

SECTION 2

STRUCTURES AND COMPONENTS SUBJECT TO AGING MANAGEMENT REVIEW

2.1 Scoping and Screening Methodology

2.1.1 Introduction

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

LRA Section 2.1, “Scoping and Screening Methodology,” describes the scoping and screening methodology used to identify the SSCs at Cooper Nuclear Station (CNS) within the scope of license renewal and the SCs subject to an AMR. The staff reviewed the scoping and screening methodology of Nebraska Public Power District (NPPD) (the applicant) to determine whether or not it meets the scoping requirements of 10 CFR 54.4(a) and the screening requirements of 10 CFR 54.21.

In developing the scoping and screening methodology for the LRA, the applicant stated that it considered the requirements of 10 CFR Part 54, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants” (the Rule), statements of consideration related to 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. Additionally, in developing this LRA methodology, the applicant stated that it considered the correspondence between the U.S. Nuclear Regulatory Commission (NRC), other applicants, and the NEI.

2.1.2 Summary of Technical Information in the Application

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

In LRA Section 2.1, the applicant describes the process used to identify the SSCs that meet the license renewal scoping criteria, in accordance with 10 CFR 54.4(a), and the process used to identify the SCs that are subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

The applicant provided the results of the process used to identify the SCs subject to an AMR in the following LRA sections:

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

- LRA Section 2.5, “Scoping and Screening Results: Electrical and Instrumentation and Controls Systems”

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

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

LRA Section 4.0, “Time-Limited Aging Analyses,” contains the applicant’s identification and evaluation of time-limited aging analyses (TLAAs).

2.1.3 Scoping and Screening Program Review

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

- 10 CFR 54.4(a), as it relates to the identification of plant SSCs within the scope of the Rule

- 10 CFR 54.4(b), as it relates to the identification of the intended functions of SSCs within the scope of the Rule

- 10 CFR 54.21(a)(1) and (a)(2), as they relate to the methods used by the applicant to identify plant SCs subject to an AMR

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

- Section 2.1, to ensure that the applicant described a process for identifying SSCs that are within the scope of license renewal in accordance with 10 CFR 54.4(a)

- Section 2.2, to ensure that the applicant described a process for determining the SCs that are subject to an AMR in accordance with 10 CFR 54.21(a)(1) and (a)(2)

In addition, the staff conducted a scoping and screening methodology audit at CNS, located in Brownville, Nebraska, during the week of May 5-8, 2009. The audit focused on ensuring that the applicant had developed and implemented adequate guidance to conduct the scoping and screening of SSCs in accordance with the methodologies described in the LRA and the requirements of the Rule. The staff reviewed implementation of the project-level guidelines and topical reports describing the applicant's scoping and screening methodology. The staff conducted detailed discussions with the applicant on the implementation and control of the license renewal program and reviewed the administrative control documentation used by the applicant during the scoping and screening process; the quality practices used by the applicant to develop the LRA; and the training and qualifications of the LRA development team.

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

2.1.3.1 *Implementation Procedures and Documentation Sources Used for Scoping and Screening*

The staff reviewed the applicant's scoping and screening implementing procedures as documented in the scoping and screening methodology audit trip report, dated June 15, 2009, to verify that the process used to identify SCs subject to an AMR was consistent with the SRP-LR. Additionally, the staff reviewed the scope of CLB documentation sources and the process used by the applicant to ensure that the applicant's commitments, as documented in the CLB and in accordance with 10 CFR Parts 54.4 and 54.21, were appropriately considered, and that the applicant adequately implemented its procedural guidance during the scoping and screening process.

2.1.3.1.1 Summary of Technical Information in the Application

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

- updated safety analysis report (USAR)
- maintenance rule basis documents
- design criteria documents (DCDs)
- fire hazards analysis
- Appendix R safe shutdown analysis report
- plant licensing and design documentation
- station drawings
- technical specifications (TSs)

2.1.3.1.2 Staff Evaluation

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

The applicant's implementing procedures contain guidance for determining plant SSCs within the scope of the Rule, and for determining which SCs within the scope of license renewal are subject to an AMR. During the review of the implementing procedures, the staff focused on the consistency of the detailed procedural guidance with information in the LRA, including the implementation of the staff positions documented in the SRP-LR, and the information in the applicant's responses, dated July 29, 2009, to the staff's requests for additional information (RAIs) dated June 29, 2009.

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

Sources of Current Licensing Basis Information. The staff reviewed the scope and depth of the applicant's CLB review to verify that the methodology is sufficiently comprehensive to identify SSCs within the scope of license renewal, as well as SCs subject to an AMR. In accordance with 10 CFR 54.3(a), the CLB is the set of NRC requirements applicable to a specific plant and an applicant's written commitments ensuring compliance with, and operation within, applicable NRC requirements and the plant-specific design bases that are docketed and in effect. The CLB includes applicable NRC regulations, orders, license conditions, exemptions, technical specifications, and design basis information (documented in the most recent USAR). The CLB also includes applicant commitments remaining in effect that were made in docketed licensing correspondence (e.g., applicant responses to NRC bulletins, generic letters (GLs), and enforcement actions) and applicant commitments documented in NRC safety evaluations or applicant event reports.

During the audit, the staff reviewed pertinent information sources used by the applicant including the USAR, DCDs, maintenance rule information, and license renewal boundary drawings. In addition, the applicant's license renewal process identified additional sources of plant information pertinent to the scoping and screening process, including fire hazards analysis, Appendix R safe shutdown analysis report, plant licensing and design documentation, station drawings, and technical specifications. The staff confirmed that the applicant's detailed license renewal program guidelines specified the use of the CLB source information in developing scoping evaluations.

The CNS equipment database, USAR, and DCDs were the applicant's primary repository for system identification and component safety classification information. During the audit, the staff reviewed the applicant's administrative controls for the CNS equipment database, design basis documents, and other information sources used to verify system information. These controls are described, and implantation is governed, by plant administrative procedures. Based on a review of the administrative controls, and a sample of the system classification information contained in the applicable CNS documentation, the staff concludes that the applicant has established adequate measures to control the integrity and reliability of CNS system identification and safety classification data, and that the information sources used by CNS during the scoping and screening process provided a sufficiently controlled source of system and component data to support scoping and screening evaluations.

During the staff's review of the applicant's CLB evaluation process, the applicant explained the incorporation of updates to the CLB and the process used to ensure those updates are adequately incorporated into the license renewal process. The staff determined that LRA Section 2.1 provided a description of the CLB and related documents used during the scoping and screening process that is consistent with the guidance contained in the SRP-LR.

In addition, the staff reviewed the implementing procedures and results reports used to support identification of SSCs that the applicant relied on to demonstrate compliance with the safety-related criteria, nonsafety-related criteria and the regulated events criteria in accordance with 10 CFR 54.4(a). The applicant's license renewal program guidelines provided a listing of documents used to support scoping and screening evaluations. The staff finds these design documentation sources to be useful for ensuring that the initial scope of SSCs identified by the applicant was consistent with the plant's CLB.

2.1.3.1.3 Conclusion

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

2.1.3.2 *Quality Controls Applied to License Renewal Application Development*

2.1.3.2.1 Staff Evaluation

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

- The scoping and screening methodology was governed by written procedures and guidelines.
- The LRA was examined by the applicant's team in a structured self-assessment.
- The LRA was examined by internal assessment teams, including a plant operation review committee and a peer review validation, both of which included different levels of plant and organizational management.
- The LRA was examined by external assessment teams, including peer reviews done by teams of personnel from other license renewal applicants.
- Comments received through the assessment process were addressed and managed by peer and management review.

The staff reviewed the applicant's written procedures and documentation of assessment activities and determined that the applicant had developed adequate procedures to control the LRA development and assess the results of the activities.

2.1.3.2.2 Conclusion

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

2.1.3.3 *Training*

2.1.3.3.1 Staff Evaluation

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

The training included the following activities:

- Engineering supervisors had prior experience supplemented with classroom training and computer-based training.
- Contractor staff had previous license renewal experience from other sites and performed a general review of the CNS License Renewal Project Guidelines and industry documents.
- Each member of the license renewal staff completed general license renewal requirements, project procedures, training in discipline-specific areas, as well as classroom and computer-based training.
- Initial qualification was completed before the project started and included the review of the license renewal process, license renewal project guidelines, and relevant industry documents (e.g., 10 CFR Part 54 regulations, NEI 95-10, Regulatory Guide (RG) 1.188, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses," SRP-LR, and NUREG-1801, "Generic Aging Lessons Learned Report," Revision 1 (GALL Report)).
- Electric Power Research Institute (EPRI) training on the fundamentals of aging degradation and management was provided to engineering supervisors and staff.

The staff reviewed the applicant's written procedures and documentation of training activities and determined that the applicant had developed and implemented adequate procedures to control the training of personnel performing LRA activities.

2.1.3.3.2 Conclusion

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

2.1.3.4 *Scoping and Screening Program Review Conclusion*

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

2.1.4 Plant Systems, Structures, and Components Scoping Methodology

LRA Section 2.1.1, "Scoping Methodology," described the applicant's methodology used to scope SSCs in accordance with 10 CFR 54.4(a) criteria. The LRA states:

> NEI 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 –The License Renewal Rule" (Reference 2.1-6), provides industry guidance for determining what SSCs are in the scope of license renewal. The process used to determine the systems and structures in the scope of license renewal for CNS followed the recommendations of NEI 95-10. Consistent with NEI 95-10, the scoping process developed a list of plant systems and structures and identified their intended functions. Intended functions are those functions that are the basis for including a system or structure within the scope of license renewal (as defined in 10 CFR 54.4(b)), and are identified by comparing the system or structure function with the criteria in 10 CFR 54.4(a).

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, "Application of Safety-Related Scoping Criteria," states:

> A system or structure is within the scope of license renewal if it performs a safety function during and following a design basis event as defined in 10 CFR 50.54(a)(1). Design basis events are defined in 10 CFR 50.49(b)(1) as conditions of normal operation, including anticipated operational occurrences, design basis accidents, external events, and natural phenomena for which the plant must be designed to ensure functions identified in 10 CFR 54.4(a)(1)(i) through (iii). The design basis events include the design basis accidents described in Chapter 14 of the CNS USAR and events described in other parts of the licensing basis documentation, such as floods, fires, tornadoes, seismic events, and high energy line breaks.

CNS USAR Section I-2.0 defines design basis events (DBEs) as follows:

> Conditions of normal operation, including anticipated operational occurrences, design basis accidents (DBAs), external events, and natural phenomena for which the plant must be designed to function to ensure:

(1) the integrity of the reactor coolant pressure boundary

(2) the capability to shut down the reactor and maintain it in a safe shutdown condition

(3) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the guidelines of 10 CFR 100, or 10 CFR 50.67, "Fuel Handling Accident"

The USAR Section I-2.0 definition of safety-related, states that safety-related functions, structures, systems, and components are those that are necessary to ensure the three items above. 10 CFR 50.67 applies to applicants who seek to revise the current accident source term used in their design basis radiological analyses. CNS has received a license amendment to apply the alternate source term to the fuel handling accident analysis in accordance with 10 CFR 50.67; therefore, the CNS definition of safety-related is consistent with the definition of safety-related SSC in 10 CFR 54.4(a)(1) and with the definition of DBEs in 10 CFR 50.49(b)(1).

2.1.4.1.2 Staff Evaluation

In accordance with 10 CFR 54.4(a)(1), the applicant must consider all safety-related SSCs relied upon to remain functional during and following a DBE to ensure the following functions: (1) the integrity of the reactor coolant pressure boundary (RCPB), (2) the ability to shut down the reactor and maintain it in a safe shutdown condition, or (3) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to those referred to in 10 CFR Parts 50.34(a)(1), 50.67(b)(2), or 100.11.

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

> The set of DBEs as defined in the Rule is not limited to Chapter 15 (or equivalent) of the [updated final safety analysis report] UFSAR. Examples of DBEs that may not be described in this chapter include external events, such as floods, storms, earthquakes, tornadoes, or hurricanes, and internal events, such as a high energy line break. Information regarding DBEs as defined in 10 CFR 50.49(b)(1) may be found in any chapter of the facility UFSAR, the Commission's regulations, NRC orders, exemptions, or license conditions within the CLB. These sources should also be reviewed to identify SSCs relied upon to remain functional during and following DBEs (as defined in 10 CFR 50.49(b)(1)) to ensure the functions described in 10 CFR 54.4(a)(1).

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

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

The staff reviewed the applicant's evaluation of the Rule and CLB definitions pertaining to 10 CFR 54.4(a)(1) and determined that the CNS definition of safety-related, documented in Section I-2.0, met the definition of safety-related specified in the Rule. The USAR also defined the term "essential," which is used in the equipment database, as being equivalent to safety-related. The staff reviewed a sample of the license renewal scoping results for: (1) main steam (MS), (2) plant drains, (3) emergency DG, and (4) turbine building to provide additional assurance that the applicant adequately implemented its scoping methodology in accordance with 10 CFR 54.4(a)(1). The staff confirmed that the applicant developed the scoping results for each of the sampled systems consistently with the methodology, identified the SSCs credited for performing intended functions, and adequately described the basis for the results, as well as the intended functions. The staff also confirmed that the applicant had identified and used pertinent engineering and licensing information to identify the SSCs required to be within the scope of license renewal in accordance with the 10 CFR 54.4(a)(1) criteria.

2.1.4.1.3 Conclusion

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

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

2.1.4.2.1 Summary of Technical Information in the Application

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

> This review identified nonsafety-related systems and structures containing components whose failure could prevent satisfactory accomplishment of a safety function. The method used was consistent with the preventive option described in Appendix F of NEI 95-10.
>
> The impact of nonsafety-related SSC failures on safety functions can be either functional or physical. A functional failure is one where the failure of a nonsafety-related SSC to perform its function impacts a safety function. A physical failure is one where a safety function is impacted by the loss of structural or mechanical integrity of a nonsafety-related SSC.

LRA Section 2.1.1.2.1, "Functional Failures of Nonsafety-Related SSCs," states:

> Where nonsafety-related equipment is required to remain functional to support a safety function (e.g., systems with components in the main steam isolation valve (MSIV) leakage pathway), the system containing the equipment has been

> included in-scope, and the function is listed as an intended function for 10 CFR 54.4(a)(2) for the system.

LRA Section 2.1.2.1.2, “Identifying Components Subject to Aging Management Review Based on Support of an Intended Function for 10 CFR 54.4(a)(2),” states:

> Appropriate LRA drawings for the systems were reviewed to identify safety-to-nonsafety interfaces. Nonsafety-related components connected to safety-related components were included to the first seismic anchor or base-mounted component. A seismic anchor is defined as hardware or structures that, as required by the analysis, physically restrain forces and moments in three orthogonal directions. Scope was typically determined by the bounding approach, which included piping beyond the safety-to-nonsafety interface up to a base-mounted component, flexible connection, or the end of a piping run (such as a vent or drain line). Also, piping isometrics were used to identify seismic anchors when required to establish scope boundary. This is consistent with the guidance in NEI 95-10, Appendix F.

LRA Section 2.1.1.2.2, “Physical Failures of Nonsafety-Related SSCs,” states:

> Nonsafety-Related SSCs Directly Connected to Safety-Related SSCs. At CNS, certain components and piping outside the safety class pressure boundary must be structurally sound in order to maintain the pressure boundary integrity of safety class piping. Systems containing such nonsafety-related SSCs directly connected to safety-related SSCs (typically piping systems) are within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2), as are buildings containing structural supports for the connected piping.
>
> Nonsafety-Related SSCs with the Potential for Spatial Interaction with Safety-Related SSCs:
>
> - Physical Impact or Flooding - This category concerns potential spatial interaction of nonsafety-related SSCs falling on or otherwise physically impacting safety-related SSCs (e.g., by causing flooding) such that safety functions may not be accomplished. Overhead handling systems whose failure could result in damage to a system that could prevent the accomplishment of a safety function are within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2). Many structural components serve as mitigating features for potential spatial interactions. Mitigating features include missile barriers, flood barriers (e.g., walls, curbs, dikes, and doors), and nonsafety-related supports for non-seismic (including seismic II/I) piping systems and electrical conduit and cable trays with potential for spatial interaction with safety-related equipment. The structure intended function, “Provide shelter and protection for safety-related equipment,” can encompass such structural component intended functions as missile barriers and flood barriers. Structures containing these components are within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2).
>
> - Pipe Whip, Jet Impingement, or Harsh Environments – Nonsafety-related portions of high-energy lines were evaluated against the criterion of

10 CFR 54.4(a)(2). Documents reviewed included the USAR and other relevant site documentation, including the DCDs. High-energy systems were evaluated to ensure identification of components that are part of nonsafety-related high-energy lines that can affect safety-related equipment. If a high-energy line break (HELB) analysis assumes that a nonsafety-related piping system does not fail, or assumes failure only at specific locations, then that piping system is within the scope of license renewal per 10 CFR 54.4(a)(2) and subject to aging management review in order to provide reasonable assurance that those assumptions remain valid through the period of extended operation.

- Spray or Leakage – Moderate and low-energy systems have the potential for spatial interactions of spray and leakage. Nonsafety-related systems and nonsafety-related portions of safety-related systems with the potential for spray or leakage that could prevent safety-related SSCs from performing their required safety function are in the scope of license renewal and subject to aging management review. The review utilized a spaces approach for scoping of nonsafety-related systems with potential spatial interaction with safety-related SSCs. The spaces approach focuses on the interaction between nonsafety-related and safety-related SSCs that are located in the same space. A “space” is defined as a room or cubicle that is separated from other spaces by substantial objects (e.g., wall, floors, and ceilings). The space is defined such that any potential interaction between nonsafety-related and safety-related SSCs, including flooding, is limited to the space. Nonsafety-related systems that contain water, oil, or steam with components located inside structures containing safety-related SSCs are potentially in-scope for possible spatial interaction under criterion 10 CFR 54.4(a)(2). These systems were evaluated further to determine if system components were located in a space such that safety-related equipment could be affected by a component failure.

2.1.4.2.2 Staff Evaluation

In accordance with 10 CFR 54.4(a)(2), the applicant must consider all nonsafety-related SSCs, whose failures could prevent the satisfactory accomplishment of safety-related functions; for SSCs relied upon to remain functional during and following a DBE to ensure (1) the integrity of the RCPB, (2) the ability to shut down the reactor and maintain it in a safe shutdown condition, or (3) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to those referred to in 10 CFR Parts 50.34(a)(1), 50.67(b)(2), or 100.11.

RG 1.188, Revision 1, endorses the use of NEI 95-10, Revision 6. NEI 95-10 discusses the staff’s position on 10 CFR 54.4(a)(2) scoping criteria, including nonsafety-related SSCs typically identified in the CLB; consideration of missiles, cranes, flooding, and HELBs; nonsafety-related SSCs connected to safety-related SSCs; nonsafety-related SSCs in proximity to safety-related SSCs; and mitigative and preventative options related to nonsafety-related and safety-related SSC interactions.

In addition, the staff's position (as discussed in NEI 95-10, Revision 6) is that applicants should not consider hypothetical failures, but rather base their evaluation on the plant's CLB, engineering judgment and analyses, and relevant operating experience. NEI 95-10 further describes operating experience as all documented plant-specific and industry-wide experience that can be used to determine the plausibility of a failure. Documentation would include NRC generic communications and event reports, plant-specific condition reports, industry reports (e.g., safety operational event reports and engineering evaluations). The staff reviewed LRA Section 2.1.1.2 in which the applicant described the scoping methodology for nonsafety-related SSCs in accordance with 10 CFR 54.4(a)(2). In addition, the staff reviewed the applicant's implementing document and results report which documented the guidance and corresponding results of the applicant's scoping review in accordance with 10 CFR 54.4(a)(2). The applicant stated that it performed the review pursuant to the guidance contained in NEI 95-10, Revision 6, Appendix F.

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

The staff determined that in order to identify the nonsafety-related SSCs connected to safety-related SSCs and required to be structurally sound to maintain the integrity of the safety-related SSCs, the applicant used the guidance contained in NEI 95-10, Appendix F, to identify the portion of nonsafety-related piping systems included within the scope of license renewal. On the basis of its review, the staff confirmed that the applicant used appropriate license renewal drawings for systems to identify the safety to nonsafety-related interfaces. Nonsafety-related components connected to safety-related components were included to the first seismic anchor or base-mounted component as stated in LRA Section 2.1.2.1.2 consistent with the guidance in NEI 95-10, Appendix F.

Nonsafety-Related SSCs with the Potential for Spatial Interaction with Safety-Related SSCs. The staff confirmed that nonsafety-related SSCs with the potential for spatial interaction with safety-related SSCs had been reviewed by the applicant for inclusion within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The staff reviewed the evaluating criteria discussed in the LRA Sections 2.1.1.2.2 and the applicant's 10 CFR 54.4(a)(2) implementing procedure. The applicant had considered physical impacts (e.g., pipe whip, jet impingement) harsh environments, flooding, spray, and leakage when evaluating the potential for spatial interactions between nonsafety-related systems and safety-related SSCs. The staff further confirmed that the applicant used a spaces approach to identify the portions of nonsafety-related systems with the potential for spatial interaction with safety-related SSCs. The spaces approach focused on the interaction between nonsafety-related and safety-related SSCs that are located in the same space, which was defined, for the purposes of the review, as a room or cubicle that is separated from other spaces by substantial objects (e.g., wall, floors, and ceilings).

LRA Section 2.1.1.2.2 and the applicant's implementing document indicate that the applicant had used a mitigative approach when considering the impact of nonsafety-related SSCs on safety-related SSCs for occurrences discussed in the CLB. The staff reviewed the applicant's

CLB information, primarily contained in the USAR, regarding missiles, flooding, and HELBs. The staff determined that the applicant had included the features designed to protect safety-related SSCs from the effects of these occurrences through the use of mitigating features such as walls, curbs, dikes, doors, whip restraints, protective covers, guard pipes, and jet impingement shields. The staff confirmed that the applicant had included the mitigating features within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).

The staff performed a walkdown of the turbine building and determined that the basement portion, which contains high-energy, fluid-filled, nonsafety-related systems, was not included within the scope of license renewal although there is a direct open path from the basement to higher elevations, which contain safety-related SSCs. The staff determined that the nonsafety-related, fluid-filled SSCs were not located in a separate space from safety-related SSCs as described in LRA Section 2.1.1.2.2.

The staff determined that additional information would be required to complete the review of the applicant's scoping methodology. In RAI 2.1-1, dated June 29, 2009, the staff requested that the applicant describe the methods used and the basis for conclusions, in determining to omit nonsafety-related, fluid-filled SSCs within the scope of license renewal when located in the same space as safety-related SSCs.

The applicant responded to RAI 2.1-1 by letter, dated July 29, 2009, which stated, in part:

> Some high energy components in the turbine building basement could release fluids that may theoretically reach equipment in upper elevations through maintenance openings. Even though a failure of this type is highly unlikely and represents a significant operating event that would be discovered prior to a loss of intended function for safety-related components, the following high energy systems and associated component types located in the turbine building basement are added to the components considered subject to aging management review based on the criterion of 10 CFR 54.4(a)(2).
>
> Extraction Steam (ES) — expansion joints, piping, rupture disk, thermowell, trap, and valve body. The component types expansion joint, piping, thermowell, and valve body are already evaluated in LRA Table 3.4.2-2-5, Extraction Steam System [10 CFR 54.4(a)(2)]. The LRA is amended to add component types rupture disk and trap to the extraction steam system evaluation as shown in Attachment 2, Changes 1 and 28.
>
> Main Steam (MS) — flow element, piping, strainer housing, trap, and valve body. The component types flow element, piping, strainer housing, and valve body are already evaluated in LRA Table 3.4.2-2-9, Main Steam System [10 CFR 54.4(a)(2)]. The LRA is amended to add component type trap to the main steam system evaluation as shown in Attachment 2, Changes 2 and 29.
>
> Reactor Feedwater (RF) — flow element, piping, pump casing, restriction orifice, strainer housing, trap, turbine casing, and valve body. The component types piping and valve body are already evaluated in LRA Table 3.4.2-2-10, Reactor Feedwater System [10 CFR 54.4(a)(2)]. The LRA is amended to add component types flow element, pump casing, restriction orifice, strainer housing, trap, and turbine casing to the reactor feedwater system evaluation as shown in Attachment 2, Changes 3 and 30.

The staff determined that the applicant's response to RAI 2.1-1 indicated that the applicant had amended the LRA to include the high energy, fluid-filled, nonsafety-related systems located in the turbine building basement within the scope of license renewal in accordance with 10 CFR 54.4(a)(2) and, therefore, RAI 2.1-1 is resolved.

In addition, the staff determined that the license renewal drawings identified certain piping as being within the scope of license renewal in accordance with 10 CFR 54.4(a)(1) up to a room or building boundary (wall). However, the drawing did not indicate that the attached piping on the opposite side of the wall was within the scope of license renewal.

The staff determined that additional information would be required to complete the review of the applicant's scoping methodology. In RAI 2.1-2, dated June 29, 2009, the staff requested the applicant address whether or not all nonsafety-related piping, attached to safety-related piping at room boundaries and extending beyond the room which contains the safety-related piping, was included within the scope of license renewal up to and including a seismic anchor or bounding condition.

The applicant responded to RAI 2.1-2 by letter, dated July 29, 2009, which stated, in part:

> NPPD reviewed all LRA drawings and applicable isometric drawings to verify that nonsafety-related piping attached to safety-related piping beyond room boundaries was included within the scope of license renewal up to and including a seismic anchor or bounding condition (basemounted component, flexible connection, or the end of a piping run). The review revealed that seismic anchors or bounding conditions at the nonsafety-related to safety-related interface are located within room boundaries as shown on the LRA drawings and are included within the yellow highlighting as in-scope and subject to aging management review per the criterion of 10 CFR 54.4(a)(2).

The staff determined that the response to RAI 2.1-2 indicated that the applicant had performed a review to verify that all nonsafety-related piping included within the scope of license renewal up to, but not beyond, room boundaries had encompassed the required seismic anchors or bounding conditions for nonsafety-related SSCs attached to safety-related SSCs. The staff determined that the applicant had verified the nonsafety-related piping included the required seismic anchor or bounding condition within the room. In addition, the staff determined that the applicant had included additional piping up to the room boundary within the scope of license renewal to prevent spatial interaction (leaking or spraying) between the nonsafety-related piping and safety-related SSCs. The staff determined that RAI 2.1-2 is resolved.

2.1.4.2.3 Conclusion

On the basis of its review of the applicant's scoping process, discussions with the applicant, and review of the information provided in the response to RAI 2.1-1 and RAI 2.1-2, the staff concludes that the applicant's methodology for identifying and including nonsafety-related SSCs, that could affect the performance of safety-related SSCs, within the scope of license renewal, is in accordance with 10 CFR 54.4(a)(2), and, therefore, is acceptable.

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

2.1.4.3.1 Summary of Technical Information in the Application

Scoping for Regulated Events. LRA Section 2.1.1.3, "Application of Criterion for Regulated Events," states:

> 10 CFR 54.4(a)(3) requires that plant SSCs within the scope of license renewal include SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), environmental qualification (10 CFR 50.49), pressurized thermal shock (10 CFR 50.61), anticipated transients without scram (10 CFR 50.62), and station blackout (10 CFR 50.63). For each of these regulated events, a report was prepared to provide input into the scoping and screening processes. These reports (1) identified the systems and structures that are relied on for each of the regulated events, and/or (2) either identified specific components, or provided a reference to the documentation to be used as input for screening.

Fire Protection. LRA Section 2.1.1.3.1, "Commission's Regulation for Fire Protection (10 CFR 50.48)," indicates that the Fire Protection Program Plan was developed to maintain compliance with 10 CFR 50.48 and Appendix R to 10 CFR 50 by meeting the following objectives in fire areas important to safety:

- reduce the likelihood of fires
- promptly detect and extinguish fires that do occur
- maintain safe shutdown capability if a fire does occur
- prevent release of a significant amount of radioactive material if a fire does occur

A review was performed to identify the specific SSCs that fall within the scope of license renewal for fire protection, including the SSCs relied upon in the Fire Protection Program Plan. As a result of that review, the following features and equipment were included within the scope of license renewal for fire protection:

- fire detection and suppression equipment
- passive fire protection features (e.g., reactor coolant pump lube oil collection components, dikes, curbs, and drains)
- fire-rated assemblies (e.g., walls, floors, ceilings, cable tray enclosures, and other fire barriers)
- fire-rated penetration assemblies (e.g., fire doors, fire dampers, cable, piping, and ventilation duct penetration seals)

- manual firefighting equipment (e.g., hydrants, hose stations, extinguishers, etc.)
- ventilation equipment (e.g., smoke removal)
- emergency lighting (e.g., fire safe shutdown and life safety lighting)
- communications equipment (e.g., fire brigade and fire safe shutdown)
- safe shutdown equipment

The screening methodology was applied to the post-fire repair equipment that is maintained in storage.

Environmental Qualification. LRA Section 2.1.1.3.2, "Commission's Regulation for Environmental Qualification (10 CFR 50.49)," indicates that CNS's Environmental Qualification (EQ) Program identifies the organizations, responsibilities, interfaces, procedures, and controls necessary to implement the EQ Program to ensure compliance with 10 CFR 50.49 requirements.

The LRA indicates that the equipment was determined to be within the scope of license renewal in accordance with 10 CFR Parts 50.49(b)(1), 50.49(b)(2), and 50.49(b)(3), including safety-related electrical equipment, nonsafety-related electrical equipment whose failure under postulated environmental conditions could prevent compliance with safety functions of the safety equipment, and certain post-accident monitoring equipment.

A bounding scoping approach is used for electrical and instrumentation and control (EIC) equipment. EIC systems and EIC equipment in mechanical systems are by default included in-scope for license renewal. This includes equipment relied upon to perform a function that demonstrates compliance with NRC regulations for environmental qualification. Consistent with the requirements specified in 10 CFR 54.4(a)(3), all SSCs relied upon to perform a function that demonstrates compliance in accordance with 10 CFR 50.49, EQ, are within the scope of license renewal.

Pressurized Thermal Shock. This regulation is not applicable to a boiling-water reactor (BWR) design.

Anticipated Transient without Scram. LRA Section 2.1.1.3.4, "Commission's Regulation for Anticipated Transients without Scram (10 CFR 50.62)," describes the scoping of systems and structures relied on in safety analysis or plant evaluations to perform a function that demonstrates compliance with the anticipated transient without scram (ATWS) criterion. The LRA states that the applicant determined the mechanical system intended functions supporting ATWS regulation based on CLB information. A bounding approach to scoping is used for EIC equipment. EIC systems and EIC equipment in mechanical systems are by default included in-scope for license renewal. Consequently, EIC equipment that supports the requirements of 10 CFR 50.62 (alternate rod injection, standby liquid control (SLC) actuation, and reactor coolant re-circulating pump trip) are included in the scope of license renewal.

Station Blackout. LRA Section 2.1.1.3.5, "Commission's Regulation for Station Blackout (10 CFR 50.49)," describes the scoping of systems and structures relied on in safety analysis or plant evaluations to perform a function that demonstrates compliance with the station blackout (SBO) criterion, and states:

> CNS has developed a four-hour coping analysis to address the requirements of 10 CFR 50.63. Based on the current licensing basis for SBO, system intended functions performed in support of 10 CFR 50.63 requirements were determined. Based on NRC guidance in NUREG-1800, Section 2.5.2.1.1, certain switchyard components required to restore offsite power are conservatively included within the scope of license renewal even though those components are not relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for station blackout. Structures that provide support, shelter, or protection for these components are considered within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(3) for 10 CFR 50.63.

The LRA further states that the applicant determined the system-intended functions supporting 10 CFR 50.63 requirements based on information contained in the CLB. Because a boundary approach for scoping EIC equipment, the onsite EIC systems and electrical equipment contained in mechanical systems are included within the scope of license renewal by default.

2.1.4.3.2 Staff Evaluation

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

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

<u>Fire Protection</u>. The staff determined that the applicant's implementing procedures indicated that it had included systems and structures in the scope of license renewal required for post fire safe shutdown, and fire detection suppression, and commitments made to Appendix A to Branch Technical Position (BTP) Auxiliary and Power Conversion Systems Branch (APCSB) 9.5-1 (BTP 9.5-1), "Guidelines for Fire Protection for Nuclear Power Plants Docketed Prior to July 1, 1976," issued May 1976. The applicant noted that it had considered CLB documents to identify systems and structures within the scope of license renewal. These documents included 10 CFR 50 Appendix R Post Fire Safe and Alternative Shutdown Analysis Report and Fire Hazards Analysis Report, which include the fire protection program plan as required by 10 CFR 50.48, USAR, drawings, operations manual, and other CNS source documents. The staff reviewed, on a sampling basis, the scoping results in conjunction with the LRA and the CLB information to validate the methodology for including the appropriate systems and structures within the scope of license renewal. The sample review showed that the systems and

structures that perform intended functions to meet 10 CFR 50.48 requirements were included within the scope of license renewal. The staff determined that the applicant's scoping methodology was acceptable for including SSCs credited in performing functions that support fire protection within the scope of license renewal.

Environmental Qualification. The staff confirmed that the applicant's implementing procedures required the inclusion of safety-related electrical equipment, nonsafety-related electrical equipment whose failure under postulated environmental conditions could prevent satisfactory accomplishments of safety functions of the safety-related equipment, and certain post accident monitoring equipment, as defined in 10 CFR 50.49(b)(1), (b)(2), and (b)(3).

The applicant employed a boundary approach for scoping plant EIC systems. All of these systems are included within the scope of license renewal, and EIC components in mechanical systems are included in the electrical systems. This method also includes within the scope of license renewal any equipment relied on to perform functions that demonstrate compliance with the EQ regulation.

The staff reviewed the LRA, implementing procedures, scoping results reports, and master EQ component equipment list to verify that the applicant identified SSCs within the scope of license renewal and met EQ requirements. Based on the review, the staff determined that the applicant's scoping methodology is acceptable for identifying EQ SSCs within the scope of license renewal.

Anticipated Transient without Scram. The staff determined that the applicant had identified the plant systems credited for ATWS mitigation based on review of the plant drawings, the USAR, docketed correspondence, modifications, and the plant equipment database. The staff reviewed these documents, and the LRA in conjunction with the scoping results to validate the methodology for identifying ATWS systems and structures that are within the scope of license renewal. The staff finds that the scoping results included systems and structures that perform intended functions in accordance with 10 CFR 50.62 requirements. The staff determined, therefore, that the applicant's scoping methodology was acceptable for identifying SSCs with functions credited for complying with the ATWS regulation.

Station Blackout. The staff determined that the applicant identified those systems and structures associated with coping, and safe shutdown of the plant following an SBO event by reviewing plant-specific SBO calculations, the USAR, drawings, modifications, the plant equipment database, and plant procedures. The staff reviewed, on a sampling basis, these documents and the LRA, in conjunction with the scoping results, to validate the applicant's methodology. The staff finds that the scoping results included systems and structures that perform intended functions in accordance with 10 CFR 50.63 requirements. The staff determined, based on its review, that the applicant's scoping methodology was acceptable for identifying SSCs credited in complying with the SBO regulation within the scope of license renewal.

2.1.4.3.3 Conclusion

On the basis of the sample reviews, discussion with the applicant, review of the LRA, and review of the implementing procedures and reports, the staff concludes that the applicant's methodology for identifying systems and structures meets the scoping criteria in accordance with10 CFR 54.4(a)(3) and, therefore, is acceptable.

2.1.4.4 *Plant-Level Scoping of Systems and Structures*

2.1.4.4.1 Summary of Technical Information in the Application

System and Structure Level Scoping. LRA Section 2.1.1, "Scoping Methodology," states:

> Consistent with NEI 95-10, the scoping process developed a list of plant systems and structures and identified their intended functions. Intended functions are those functions that are the basis for including a system or structure within the scope of license renewal (as defined in 10 CFR 54.4(b)) and are identified by comparing the system or structure function with the criteria in 10 CFR 54.4(a).
>
> The CNS equipment database was used to develop a list of plant systems. The equipment database is a controlled list of plant systems and components. Components in the database have unique identifiers that include the system code assigned to the component.
>
> For mechanical system scoping, a system is defined as the collection of components in the equipment database assigned to the system code. System functions are determined based on the functions performed by those components. As the starting point for structural scoping, a list of plant structures was developed from a review of the USAR, site drawings, Fire Hazards Analysis, design criteria documents, and maintenance rule basis documents. The list includes structures that potentially support plant operations or could adversely impact structures that support plant operations.
>
> Intended functions for structures and mechanical systems were identified based on reviews of applicable plant licensing and design documentation. Documents reviewed included applicable sections of the USAR, maintenance rule basis documents, design criteria documents, the Fire Hazards Analysis, the Appendix R Safe Shutdown Analysis Report, Technical Specifications, and various station drawings as necessary. Each structure and mechanical system was evaluated against the criteria of 10 CFR 54.4.
>
> For the purposes of system level scoping, plant electrical and instrumentation and control (EIC) systems are included in the scope of license renewal by default. EIC components in mechanical systems are included in the evaluation of EIC components, regardless of whether the mechanical system is included in-scope. Switchyard equipment, which is not part of the plant's EIC systems, was reviewed for station blackout (SBO) intended functions based on NRC guidance in NUREG-1800.

Consumables. LRA Section 2.1.2.4, "Consumables," and subsections, state:

Packing, Gaskets, Component Seals, and O-Rings. Packing, gaskets, component mechanical seals, and O-rings are typically used to provide a leak-proof seal when components are mechanically joined together. These items are commonly found in components such as valves, pumps, heat exchangers, ventilation units or ducts, and piping segments. In accordance with American National Standards Institute (ANSI) B31.1 and the [American Society of Mechanical Engineers] ASME Boiler and Pressure Vessel (B&PV) Code Section III, the subcomponents of pressure retaining components as shown above are not considered pressure-retaining parts.

Therefore, these subcomponents are not relied on to perform a license renewal intended function and are not subject to aging management review.

Structural Sealants. Elastomers and other materials used as structural sealants are subject to aging management review if they are not periodically replaced and they perform an intended function, typically supporting a pressure boundary, flood barrier, or rated fire barrier. Seals and sealants are considered in the aging management review of bulk commodities.

Oil, Grease, and Filters. Oil, grease, and component filters have been treated as consumables because either (1) they are periodically replaced or (2) they are monitored and replaced based on condition.

System Filters, Fire Extinguishers, Fire Hoses, and Air Packs. Components such as system filters, fire hoses, fire extinguishers, self-contained breathing apparatus (SCBA), and SCBA cylinders are considered to be consumables and are routinely tested, inspected, and replaced when necessary. Fire protection at CNS complies with the applicable safety standards (e.g., BTP-APCSB 9.5.1, National Fire Protection Association document NFPA-10-1975 for fire extinguishers, NFPA-1962 for fire hoses, NFPA Standard-1981 for SCBA Air cylinders, 29 CFR 1910.134 for respiratory protection), which specify performance and condition monitoring programs for these specific components. Fire hoses and fire extinguishers are inspected and hydrostatically tested periodically and must be replaced if they do not pass the test or inspection. SCBA and SCBA cylinders are inspected and periodically tested and must be replaced if they do not pass the test or inspection. Fire protection procedures specify the replacement criterion of these components that are routinely checked by tests or inspections to assure operability. Therefore, while these consumables are in the scope of license renewal, they do not require an aging management review.

2.1.4.4.2 Staff Evaluation

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

The applicant documented the results of the plant-level scoping process in accordance with the implementing procedures. The results were provided in the systems and structures documents and reports which contained the following information: a description of the structure or system, a listing of functions performed by the system or structure, identification of intended functions, the 10 CFR 54.4(a) scoping criteria met by the system or structure, references, and the basis for the classification of the system or structure-intended functions. During the audit, the staff reviewed a sampling of the documents and reports related to system level scoping and the treatment of consumables, and concluded that the applicant's scoping results contained an appropriate level of detail to document the scoping process.

2.1.4.4.3 Conclusion

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

2.1.4.5 *Mechanical Scoping*

2.1.4.5.1 Summary of Technical Information in the Application

LRA Section 2.1.1 states:

> Consistent with NEI 95-10, the scoping process developed a list of plant systems and identified their intended functions. Intended functions are those functions that are the basis for including a system or structure within the scope of license renewal (as defined in 10 CFR 54.4(b)) and are identified by comparing the system function with the criteria in 10 CFR 54.4(a).
>
> The CNS equipment database was used to develop a list of plant systems. The equipment database is a controlled list of plant systems and components. Components in the database have unique identifiers that include the system code assigned to the component. For mechanical system scoping, a system is defined as the collection of components in the equipment database assigned to the system code. System functions are determined based on the functions performed by those components.
>
> Intended functions for mechanical systems were identified based on reviews of applicable plant licensing and design documentation. Documents reviewed included applicable sections of the USAR, maintenance rule basis documents, design criteria documents, the Fire Hazards Analysis, the Appendix R Safe Shutdown Analysis Report, Technical Specifications, and various station drawings as necessary. Each mechanical system was evaluated against the criteria of 10 CFR 54.4.

2.1.4.5.2 Staff Evaluation

The staff evaluated LRA Section 2.1.1, and the guidance contained in the implementing procedures and reports, to perform the review of the mechanical scoping process. The project documents and reports provided instructions for identifying the evaluation boundaries. Determination of the mechanical system evaluation boundary required an understanding of system operations in support of intended functions.

The staff determined that the process was based on the review of the USAR, DCDs, the plant equipment database, NRC docketed correspondence and documents, and plant drawings. The evaluation boundaries for mechanical systems were documented on license renewal boundary drawings that were created by marking mechanical piping and instrumentation diagrams to indicate the components within the scope of license renewal. The staff determined that components within the evaluation boundary were reviewed to determine whether or not they perform an intended function. Intended functions were established based on if a particular function of a component was necessary to support the system functions that meet the scoping criteria.

The staff reviewed the implementing procedures and the CLB documents associated with mechanical system scoping. The staff finds that the guidance and CLB source information noted above is acceptable in identifying mechanical components and support structures in mechanical systems that are within the scope of license renewal. The staff conducted detailed discussions with the applicant's license renewal project personnel and reviewed documentation pertinent to the scoping process. The staff assessed whether the applicant had appropriately applied the scoping methodology outlined in the LRA and implementing procedures, and whether or not the scoping results were consistent with CLB requirements. The staff determined that the applicant's procedure was consistent with the description provided in the LRA Section 2.1.1 and the guidance contained in the SRP-LR Section 2.1, and was adequately implemented.

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

2.1.4.5.3 Conclusion

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

2.1.4.6 *Structural Scoping*

2.1.4.6.1 Summary of Technical Information in the Application

LRA Section 2.1.1 states:

> Consistent with NEI 95-10, the scoping process developed a list of plant structures and identified their intended functions. Intended functions are those functions that are the basis for including a system or structure within the scope of license renewal (as defined in 10 CFR 54.4(b)) and are identified by comparing the system or structure function with the criteria in 10 CFR 54.4(a).

As the starting point for structural scoping, a list of plant structures was developed from a review of the USAR, site drawings, Fire Hazards Analysis, design criteria documents, and maintenance rule basis documents. The list includes structures that potentially support plant operations or could adversely impact structures that support plant operations.

Intended functions for structures were identified based on reviews of applicable plant licensing and design documentation. Documents reviewed included applicable sections of the USAR, maintenance rule basis documents, design criteria documents, the fire hazards analysis, the Appendix R Safe Shutdown Analysis Report, technical specifications, and various station drawings as necessary. Each structure was evaluated against the criteria of 10 CFR 54.4.

2.1.4.6.2 Staff Evaluation

The staff evaluated LRA Section 2.1.1 and the guidance contained in the implementing procedures and reports to perform the review of the structural scoping process. The staff reviewed the applicant's approach to identifying structures relied upon to perform the functions in accordance with 10 CFR 54.4(a). As part of this review, the staff discussed the methodology with the applicant, reviewed the documentation developed to support the review, and evaluated the scoping results for a sample of structures that were identified within the scope of license renewal. The staff determined that the applicant had identified and developed a list of plant structures and the structures' intended functions through a review of the plant equipment database, USAR, DCDs, drawings, procedures, and walkdowns. Each structure the applicant identified was evaluated against the criteria of 10 CFR 54.4(a)(1), (a)(2), and (a)(3).

The staff reviewed selected portions of the plant equipment database, USAR, DCDs, drawings, procedures, and implementing procedures to verify the adequacy of the methodology. The staff reviewed the applicant's methodology for identifying structures meeting the scoping criteria as defined in the Rule. The staff also reviewed the scoping methodology implementing procedures and discussed the methodology and results with the applicant. In addition, the staff reviewed, on a sampling basis, the applicant's scoping reports including information contained in the source documentation for the plant drains and the turbine building to verify that application of the methodology would provide the results as documented in the LRA. The staff confirmed that the applicant had identified and used pertinent engineering and licensing information in order to determine that the turbine building and the screenhouse were required to be included within the scope of license renewal. As part of the review process, the staff evaluated the intended functions identified for the plant drains, the turbine building, and the structural components, the basis for inclusion of the intended function, and the process used to identify each of the component types.

2.1.4.6.3 Conclusion

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

2.1.4.7 *Electrical Scoping*

2.1.4.7.1 Summary of Technical Information in the Application

LRA Section 2.1.1 states:

> Consistent with NEI 95-10, the scoping process developed a list of plant systems and structures and identified their intended functions. Intended functions are those functions that are the basis for including a system or structure within the scope of license renewal (as defined in 10 CFR 54.4(b)) and are identified by comparing the system or structure function with the criteria in 10 CFR 54.4(a).
>
> The CNS equipment database was used to develop a list of plant systems. The equipment database is a controlled list of plant systems and components. Components in the database have unique identifiers that include the system code assigned to the component.
>
> For the purposes of system level scoping, plant electrical and instrumentation and control (EIC) systems are included in the scope of license renewal by default. EIC components in mechanical systems are included in the evaluation of EIC components, regardless of whether the mechanical system is included in-scope. Switchyard equipment, which is not part of the plant's EIC systems, was reviewed for station blackout (SBO) intended functions based on NRC guidance in NUREG-1800.

2.1.4.7.2 Staff Evaluation

The staff evaluated LRA Section 2.1.1 and the guidance contained in the implementing procedures and reports to perform the review of the electrical scoping process. The staff reviewed the applicant's approach to identifying EIC SSCs relied upon to perform the functions described in 10 CFR 54.4(a). The staff reviewed portions of the documentation used by the applicant to perform the electrical scoping process including the USAR, plant equipment database, CLB documentation, DCDs, databases and documents, procedures, drawings, specifications, and codes and standards. As part of this review, the staff discussed the methodology with the applicant, reviewed the implementing procedures developed to support the review, and evaluated the scoping results for a sample of SSCs that were identified within the scope of license renewal. The staff determined that the applicant had included EIC components and also EIC components contained in mechanical or structural systems within the scope of license renewal on a commodity basis.

2.1.4.7.3 Conclusion

On the basis of its review of information contained in the LRA and supporting documents, discussions with the applicant, and a sampling review of electrical scoping results, the staff concludes that the applicant's methodology for the identification of EIC SSCs within the scope of license renewal is in accordance with 10 CFR 54.4 and, therefore, is acceptable.

2.1.4.8 *Scoping Methodology Conclusion*

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

2.1.5 Screening Methodology

2.1.5.1 *General Screening Methodology*

2.1.5.1.1 Summary of Technical Information in the Application

LRA Section 2.1.2, "Screening Methodology," states:

> Screening is the process for determining which components and structural elements require aging management review. Screening is governed by 10 CFR 54.21(a), which reads as follows: NEI 95-10 (Reference 2.1-6) provides industry guidance for screening structures and components to identify the passive, long-lived structures and components that support an intended function. The screening process for CNS followed the recommendations of NEI 95-10. Within the group of systems and structures that are in-scope, passive long-lived components or structural elements that perform intended functions require aging management review. Components or structural elements that are either active or subject to replacement based on a qualified life do not require aging management review.

2.1.5.1.2 Staff Evaluation

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

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

The staff determined that the screening process evaluated the component types and commodity groups, included within the scope of license renewal, and determined which ones were long-lived and passive and therefore subject to an AMR. The staff reviewed LRA Section 2.3, "Scoping and Screening Results: Mechanical Systems," LRA Section 2.4, "Scoping and Screening Results: Structures," and LRA Section 2.5, "Scoping and Screening Results:

Electrical and Instrumentation and Control Systems." These sections of the LRA provided the results of the process used to identify component types and commodity groups subject to an AMR. The staff also reviewed, on a sampling basis, the screening results reports for the plant drains, emergency DG, MS, and the turbine building.

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

2.1.5.1.3 Conclusion

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

2.1.5.2 *Mechanical Component Screening*

2.1.5.2.1 Summary of Technical Information in the Application

LRA Section 2.1.2.1, "Screening of Mechanical Systems," states:

> As required by 10 CFR 54.21(a), the screening process identified those components that are subject to aging management review for each mechanical system within the scope of license renewal.

LRA Section, 2.1.2.1.1, "Identifying Components Subject to Aging Management Review," states:

> Within the system, components are subject to aging management review if they perform an intended function without moving parts or a change in configuration or properties and if they are not subject to replacement based on a qualified life or specified time period.
>
> In making the determination that a component performs an intended function without moving parts or a change in configuration or properties, it is not necessary to consider the piece parts of the component. However, in the case of valves, pumps, and housings for fans and dampers, the valve bodies, pump casings, and housings may perform an intended function by maintaining the pressure boundary and may therefore be subject to aging management review.
>
> Replacement programs are based on vendor recommendations, plant experience, or any means that establishes a specific service life, qualified life, or replacement frequency under a controlled program. Components that are subject to replacement based on qualified life or specified time period are not subject to aging management review. Where flexible elastomer hoses/expansion joints or other components are periodically replaced, these components are not subject to aging management review.

2.1.5.2.2 Staff Evaluation

The staff reviewed the mechanical screening methodology discussed and documented in LRA Section 2.1.2.1 and subsections, the implementing procedures, the scoping and screening reports, and the license renewal drawings. The staff determined that the mechanical system screening process began with the results from the scoping process and that the applicant reviewed each system evaluation boundary as illustrated on P&IDs to identify passive and long-lived components. In addition, the staff determined that the applicant had identified all passive, long-lived components that perform or support an intended function, within the system evaluation boundaries, and determined those components to be subject to an AMR. The results of the review were documented in the scoping and screening reports which contain information, such as the information sources reviewed and the component's intended functions.

The staff confirmed that mechanical system evaluation boundaries were established for each system within the scope of license renewal and that the boundaries were determined by mapping the system intended-function boundary onto P&IDs. The staff confirmed that: (a) the applicant reviewed the components within the system intended-function boundary to determine if the component supported the system intended-function and (b) if those components that supported the system intended-function were reviewed to determine if the component was passive and long-lived and, therefore, subject to an AMR.

The staff reviewed selected portions of the USAR, plant equipment database, CLB documentation, DCDs, databases and documents, procedures, drawings, specifications, codes and standards, and selected scoping and screening reports. The staff conducted detailed discussions with the applicant's license renewal team and reviewed documentation pertinent to the screening process. The staff assessed whether or not the mechanical screening methodology outlined in the LRA and procedures were appropriately implemented and if the scoping results were consistent with CLB requirements. During the scoping and screening methodology audit, the staff discussed the screening methodology with the applicant, and on a sampling basis, reviewed the applicant's screening reports for the emergency DG and MS systems to verify proper implementation of the screening process. Based on these audit activities, the staff did not identify any discrepancies between the documented methodology and the implementation results.

2.1.5.2.3 Conclusion

On the basis of its review of the LRA, the screening implementing procedures, selected portions of the USAR, plant equipment database, CLB documentation, DCDs, databases and documents, procedures, drawings, specifications, codes and standards, selected scoping and screening reports, and a sample of the MS and residual heat removal (RHR) systems screening results, the staff concludes that the applicant's methodology for identification of mechanical components within the scope of license renewal and subject to an AMR is in accordance with 10 CFR 54.21(a)(1) and, therefore, is acceptable.

2.1.5.3 *Structural Component Screening*

2.1.5.3.1 Summary of Technical Information in the Application

LRA Section 2.1.2.2, "Screening of Structures," states:

> For each structure within the scope of license renewal, the structural components and commodities were evaluated to determine those subject to aging management review. This evaluation (screening process) for structural components and commodities involved a review of design basis documents, design drawings, general arrangement drawings, penetration drawings, and the USAR to identify specific structural components and commodities that make up the structure. Structural components and commodities subject to aging management review are those that (1) perform an intended function without moving parts or a change in configuration or properties, and (2) are not subject to replacement based on qualified life or specified time period

LRA Section 2.1.2.2.1, "Structural Component and Commodity Groups," states:

> Structural components and commodities often have no unique identifiers such as those given to mechanical components. Therefore, grouping structural components and commodities based on materials of construction provided a practical means of categorizing them for aging management reviews. Structural components and commodities were categorized by the following groups based on materials of construction.

LRA Section 2.1.2.2.3, "Intended Functions," states:

> Structural components and commodities were evaluated to determine intended functions as they relate to license renewal. NEI 95-10 provides guidelines for determining the intended functions of structures, structural components, and commodities. Structural component and commodity intended functions include providing shelter or protection and providing structural or functional support. Many structural components either have the potential for spatial interaction with safety-related equipment (e.g., cranes, hoists) or serve as mitigating features for potential spatial interactions. Mitigating features include missile barriers, flood barriers, HELB protection, and nonsafety-related supports for non-seismic piping systems and electrical conduit and cable trays with potential for spatial interaction with safety-related equipment.

2.1.5.3.2 Staff Evaluation

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

The staff reviewed selected portions of the USAR, and scoping and screening reports which the applicant had used to perform the structural scoping and screening activities. The staff also reviewed, on a sampling basis, the civil (structural) boundary drawing to document the SCs within the scope of license renewal. The staff conducted detailed discussions with the applicant's license renewal team and reviewed documentation pertinent to the screening process to assess if the screening methodology outlined in the LRA and implementing procedures was appropriately implemented, and if the scoping results were consistent with CLB requirements. During the scoping and screening methodology audit, the staff reviewed, on a sampling basis, the applicant's screening reports for the plant drains and the turbine building to verify proper implementation of the screening process. Based on these onsite review activities, the staff did not identify any discrepancies between the methodology documented and the implementation results.

2.1.5.3.3 Conclusion

On the basis of its review of the LRA, implementing procedures, the USAR, DCDs, scoping and screening reports, and a sampling review of the turbine building screening results, the staff concludes that the applicant's methodology for identification of structural components within the scope of license renewal and subject to an AMR is in accordance with 10 CFR 54.21(a)(1) and, therefore, is acceptable.

2.1.5.4 *Electrical Component Screening*

2.1.5.4.1 Summary of Technical Information in the Application

LRA Section 2.1.2.3, "Electrical and Instrumentation and Control Systems," states:

> The EIC aging management review evaluates commodity groups containing components with similar characteristics. Screening applied to commodity groups determines which EIC components are subject to aging management review. An aging management review is required for commodity groups that perform an intended function, as described in 10 CFR 54.4, without moving parts or without a change in configuration or properties (passive) and that are not subject to replacement based on a qualified life or specified time period (long-lived).

LRA Section 2.1.2.3.1, "Passive Screening," states:

> NEI 95-10, Appendix B, "Typical Structure, Component and Commodity Groupings and Active/Passive Determinations for the Integrated Plant Assessment," identifies electrical commodities considered to be passive. CNS electrical commodity groups correspond to two of the NEI 95-10 passive EIC commodity groups. These are the electrical commodity groups that meet the 10 CFR 54.21(a)(1)(i) criterion (i.e., components that perform an intended function without moving parts or without a change in configuration):
>
> - high-voltage insulators, and
> - cables and connections, bus, electrical portions of EIC penetration assemblies, fuse holders outside of cabinets of active electrical components.

Other CNS EIC commodity groups are active and do not require aging management review.

LRA Section 2.1.2.3.2, “Long-Lived Screening,” states:

> Electrical components and EIC penetration assemblies included in the environmental qualification (EQ) program per 10 CFR 50.49 are subject to replacement based on their qualified life. Therefore, in accordance with 10 CFR 54.21(a)(1)(ii), EQ components are not subject to aging management review. EQ components are covered by analyses or calculations that may be time-limited aging analyses (TLAAs), as defined in 10 CFR 54.3.

2.1.5.4.2 Staff Evaluation

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

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

The staff performed a review to determine if the screening methodology outlined in the LRA and implementing procedures were appropriately implemented and if the scoping results were consistent with CLB requirements. During the scoping and screening methodology audit, the staff reviewed selected screening reports and discussed the reports with the applicant to verify proper implementation of the screening process. Based on these onsite review activities, the staff did not identify any discrepancies between the methodology documented and the implementation results.

2.1.5.4.3 Conclusion

On the basis of its review of the LRA and supporting documents, discussion with the applicant, and a sample of the results of the screening methodology, the staff concludes that the applicant’s methodology for identification of electrical components within the scope of license renewal and subject to an AMR is in accordance with 10 CFR 54.21(a)(1) and, therefore, is acceptable.

2.1.5.5 *Screening Methodology Conclusion*

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

2.1.6 Summary of Evaluation Findings

On the basis of its review of the information presented in LRA Section 2.1, the supporting information in the scoping and screening implementing procedures and reports, the information presented during the scoping and screening methodology audit, discussions with the applicant sample system reviews, and the applicant's response to the staff's RAIs dated June 29, 2009, the staff confirms that the applicant's scoping and screening methodology is in accordance with 10 CFR Parts 54.4 and 54.21(a)(1). The staff also concludes that the applicant's description and justification of its scoping and screening methodology are in accordance with 10 CFR 54.21(a)(1). From this review, the staff concludes that the applicant's methodology for identifying systems and structures within the scope of license renewal and SCs requiring an AMR is acceptable.

2.2 Plant-Level Scoping Results

2.2.1 Staff Evaluation

The purpose of the staff's evaluation was to determine whether the applicant properly identified the systems and structures within the scope of license renewal in accordance with 10 CFR 54.4. The staff's review focused on the implementation results shown in LRA Tables 2.2-1, 2.2-2, 2.2-3, and 2.2-4 to confirm that there were no omissions of plant-level systems and structures within the scope of license renewal.

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

In RAI 2.2-1, dated May 1, 2009, the staff noted the auxiliary condensate (AC) system was identified in LRA Table 2.2-2 as not within the scope of license renewal. In USAR Section VI-3.0, the applicant identified the reactor building AC supply system as the water supply for each emergency core cooling system (ECCS) pump discharge line. On LRA Drawing 2049, sheet 3, the applicant shows components in the reactor building AC system are highlighted as within the scope of license renewal in accordance with 10 CFR 54.4 (a)(2). The staff requested the applicant justify the exclusion of the AC system from the scope for license renewal.

In its response to RAI 2.2-1, dated May 28, 2009, the applicant explained that the "AC" system code in the equipment database includes components collectively known as the AC system, described in USAR Section X-10.1.1 as the steam heating system. The AC system is a nonsafety-related system. Its sole function is to provide condensate to the auxiliary steam (AS) boilers. The AC components are located in the boiler room, which contains no safety-related components. Therefore, the applicant determined that the AC system components do not have any intended functions for 10 CFR 54.4(a)(1), (a)(2), or (a)(3). The components for the reactor building AC supply system are part of the condensate makeup (CM) system and are included within the scope of license renewal.

Based on its review, the staff found the response to RAI 2.2-1 acceptable because the applicant identified that the AC system components did not have any safety functions and were solely in a building that did not contain any safety-related components.

In RAI 2.2-2, dated May 1, 2009, the staff noted that the main generator seal oil system was not identified as a system in the scope of license renewal. The system contains fluid-filled components and is located in the turbine building, which contains SCs that are safety-related and within the scope of license renewal in accordance with 10 CFR 54.4 (a)(1). The staff requested the applicant to justify the exclusion of the main generator seal oil system from the scope of license renewal.

In its response to RAI 2.2-2, dated May 28, 2009, the applicant explained that components supplying seal oil to the main generator are assigned to the turbine generator lube oil (LO) system, which is within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). Component types associated with the seal oil portion of the LO system are subject to an AMR and listed in LRA Table 2.3.4-2-6.

Based on its review, the staff found the response to RAI 2.2-2 acceptable because the applicant identified that the components of the seal oil system were included within the generator LO system and subject to an AMR.

In RAI 2.2-3, dated May 1, 2009, the staff noted that in the USAR Section XII-2.1, the applicant provides a definition of Class I structures and equipment applicable to structural design requirements, followed by a list of Class I structures and equipment. The USAR section states that Class I SCs are required for safe shutdown and isolation of the reactor. The definition of Class I in the USAR also includes components whose failure could cause significant release of radioactivity or are vital to a safe shutdown. This USAR definition of Class I is comparable to the definition of components required to be within the scope of license renewal in accordance with 10 CFR 54.4 (a)(1). The USAR lists several structures and equipment as Class I that are not included as within the scope of license renewal in accordance with 10 CFR 54.4 (a)(1). The list includes the following structures and equipment: the radwaste building (below grade), radwaste storage tanks, reactor water cleanup (RWCU) phase separators, and reactor building floor drain sump pumps. The staff requested the applicant to justify the exclusion of those SCs, identified as Class I in the USAR, from inclusion as within the scope of license renewal in accordance with 10 CFR 54.4(a)(1).

In its response to RAI 2.2-3, dated May 28, 2009, the applicant explained that the USAR Section XII-2.1 discussion of Class I does not align with the definition of safety-related.

Safety-related SSCs must meet Class I requirements. However, not every SSC designed to Class I requirements has to be safety-related. Therefore, there are some Class I structures and equipment that are not safety-related. The applicant performed scoping for license renewal based on the functions of equipment against the criteria of 10 CFR 54.4, rather than on their seismic qualifications. The applicant's review of the specific SCs, radwaste building (below grade), radwaste storage tanks, and RWCU phase separators, determined the structures did not contain safety-related SSCs, nor do the SCs perform any safety function necessary to shut down the reactor, maintain it in a safe shutdown condition, or are required to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to those referred to in 10 CFR Parts 50.34(a)(1), 50.67(b)(2), or 100.11. Therefore, the applicant's evaluation determined that the structures and equipment mentioned did not meet the criteria of 10 CFR 54.4(a)(1).

Based on its review, the staff found the response to RAI 2.2-3 acceptable because the applicant evaluated the structures and equipment identified in the USAR as Class I and determined that the SCs did not meet the requirements to be classified under 10 CFR 54.4(a)(1). Those SCs that did meet the requirement to be within the scope of license renewal in accordance with 10 CFR 54.4(a)(1) were included and subject to an AMR.

In RAI 2.2-4, dated May 1, 2009, the staff noted that in the USAR Section XII-2.1, the definition of Class II structures and equipment states that Class II designated items shall not degrade the integrity of any items designated Class I. The applicant's identification of Class II structures is comparable with SCs required to be included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The staff requested the applicant to justify the exclusion of the Class II structures and equipment listed in the USAR from the scope of license renewal in accordance with 10 CFR 54.4 (a)(2).

In its response to RAI 2.2-4, dated May 28, 2009, the applicant explained that the USAR Section XII-2.1 states, "A Class II designated item shall not degrade the integrity of any item designated Class I." The applicant interpreted this statement to mean "that Class II design requirements are acceptable for structures whose failure will not degrade the integrity of any item designated Class I." Thus, the applicant concluded that a Class II structure does not meet the scoping criterion of 10 CFR 54.4(a)(2). The applicant did not use the structure's classification in the USAR for scoping criteria, but rather scoped structures in accordance with 10 CFR 54.4(a). The applicant included within the scope of license renewal those buildings that provide support and protection to in-scope equipment. The applicant's specific evaluation of Class II structures and equipment is as follows.

The applicant's evaluation of Class II structures, specifically the optimum water chemistry gas generator (OWCGG) building, the augmented radwaste building (ARB), the office building, and the discharge structure (seal well), found that these structures neither contain any safety-related equipment nor provide shelter or protection to equipment within the scope of license renewal. Failure of these structures will not prevent satisfactory accomplishment of a safety function; therefore, the applicant concluded that these buildings do meet the criteria of 10 CFR 54.4(a)(2).

The applicant's evaluation of the turbine building, off-gas (OG) building, radwaste building, and railroad airlock found that these structures are included within the scope of license renewal. Also, the service water pipe slab is within the scope of license renewal and subject to an AMR, as indicated in LRA Table 2.4-2.

The applicant's evaluation of the multi-purpose facility (MPF) found that the MPF does not contain safety-related equipment and does not provide shelter or protection to 10 CFR 54.4 (a)(1) or (a)(2) equipment. However, the MPF houses fire protection equipment used to meet 10 CFR 50.48 requirements for fire protection. Class I buildings located next to the MPF are separated by the seismic isolation joint, preventing a failure of the MPF from affecting adjacent Class I buildings. Therefore, the MPF does not have a function that meets the criterion of 10 CFR 54.4(a)(2), but is in accordance with 10 CFR 54.4(a)(3).

The applicant evaluated the Class II equipment listed in the USAR, specifically the augmented OG treatment system. The applicant determined that the augmented OG treatment system contains only dry air or gas and is not required for structural support of safety-related equipment; therefore, the augmented OG treatment system was not required to be in accordance with 10 CFR 54.4(a)(2).

Based on its review, the staff found the response to RAI 2.2-4 acceptable because the applicant evaluated the structures and equipment identified in the USAR as Class II and determined whether or not they met the requirements to be classified under 10 CFR 54.4(a)(2). The SCs that met the requirement were included within the scope of license renewal and subject to an AMR.

2.2.2 Conclusion

The staff reviewed LRA Section 2.2, the RAI responses, and the USAR supporting information to determine whether or not the applicant failed to identify any systems and structures within the scope of license renewal. On the basis of its review, the staff concludes that the applicant has appropriately identified the systems and structures within the scope of license renewal in accordance with 10 CFR 54.4 and, therefore, is acceptable.

2.3 Scoping and Screening Results: Mechanical Systems

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

- reactor vessel (RV), reactor vessel internals (RVIs), and reactor coolant system (RCS) or RCPB
- engineered safety features (ESFs)
- auxiliary systems
- steam and power conversion systems

This staff evaluation of the mechanical system scoping and screening results applies to all mechanical systems reviewed. Those systems that required RAIs to be generated during the review will include an additional staff evaluation discussion in their respective subsections in this SER, where the staff specifically addresses the applicant's responses to the RAIs.

In accordance with 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 the applicant has identified the mechanical system SCs that meet the scoping criteria and are subject to an AMR.

The staff's evaluation of the information in the LRA was the same for all mechanical systems. The staff performed the evaluation using the evaluation methodology described here and the guidance in SRP-LR Section 2.3, and also took into account (where applicable) the system functions described in the USAR. The objective was to determine whether or not the applicant identified, in accordance with 10 CFR 54.4, components and supporting structures for mechanical systems that meet the license renewal scoping criteria. Similarly, the staff evaluated the applicant's screening results to verify that all passive, long-lived components were subject to an AMR in accordance with 10 CFR 54.21(a)(1).

In the scoping evaluation, the staff reviewed the LRA, USAR, license renewal boundary drawings, and other licensing basis documents, as appropriate, for each mechanical system within the scope of license renewal. The staff reviewed the licensing basis documents to confirm that the LRA specified all intended functions in accordance with 10 CFR 54.4(a). The review then focused on identifying components with intended functions in accordance with 10 CFR 54.4(a) that had not been identified as within the scope of license renewal.

The staff then evaluated the applicant's screening results. For the SCs with intended functions in accordance with 10 CFR 54.4(a), the staff determined whether or not the functions are performed with moving parts or a change in configuration or properties, or the SCs are subject to replacement after a qualified life or specified time period, in accordance with 10 CFR 54.21(a)(1). For SCs not meeting either of these criteria, the staff confirmed that the SCs are subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.1 Reactor Coolant System

The RCS consists of components in the nuclear boiler system code and the RCPB, which includes ASME Class 1 components. The system is broken down into the RV, the RVIs, and the RCPB. The applicant described the supporting SCs of the RV, RVIs, and RCS in the following LRA sections:

- 2.3.1.1,"Reactor vessel;
- 2.3.1.2,"Reactor vessel internals;"
- and 2.3.1.3,"Reactor coolant system pressure boundary."

2.3.1.1 *Reactor Vessel*

2.3.1.1.1 Summary of Technical Information in the Application

The RV is a vertical, cylindrical pressure vessel with hemispherical heads of welded construction. The RV sits vertically on a low-alloy steel skirt that is welded to it. The skirt sits on a ring girder that is part of the primary containment (PC) foundation. The vessel is constructed of low-alloy steel with a stainless steel cladding on the inside. The bottom head is welded to the cylindrical shell and the top head is attached to the rest of the vessel by the closure studs and nuts.

The RV also supports multiple internal components. There are attachments that support the guide rod brackets, steam dryer support brackets, feedwater (FW) sparger brackets, jet pump riser brackets, core spray (CS) brackets, and surveillance specimen holder brackets.

There are also multiple penetrations into the RV. Vessel nozzles connect the vessel to the FW, MS, recirculation, CS, standby liquid control (SLC), control rod drive mechanisms (CRDMs), in-core flux instrumentation, vents, drains, head seal leak detection piping, and RV level and pressure sensing lines.

The RV acts as a boundary for neutrons as well. It provides a volume to flood the core and keep it cool as well as flowpaths for water and steam.

The intended functions of the RV within the scope of license renewal include providing a pressure boundary and structural support.

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

2.3.1.1.2 Staff Evaluation

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

2.3.1.1.3 Conclusion

The staff reviewed the LRA and the USAR to determine whether or not the applicant failed to identify any SSCs in the RV within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has acceptably identified the RV components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and those subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.1.2 *Reactor Vessel Internals*

2.3.1.2.1 Summary of Technical Information in the Application

The RVIs are supported by the RV. The RVIs include the core shroud, shroud head and steam separator assembly, core support and top guide assembly, jet pump assemblies, FW spargers, control rod guide tubes, and steam dryers.

The RVIs distribute the flow of coolant delivered to the vessel, locate and support the fuel assemblies, separate moisture from the steam leaving the vessel, and provide an inner volume containing the core that can be flooded following a break in the nuclear system process barrier external to the RV.

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

2.3.1.2.2 Staff Evaluation

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

2.3.1.2.3 Conclusion

The staff reviewed the LRA and the USAR to determine whether or not the applicant failed to identify any SSCs of the RVIs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has appropriately identified the RVIs within the scope of license renewal, in accordance with 10 CFR 54.4(a), and those subject to an AMR, in accordance with 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

The RCPB includes the RV and attached piping out to and including the second isolation valve. The RCPB serves as the primary pressure boundary for the reactor coolant.

The LRA lists the functions of the RCPB within the scope of license renewal which include the following: provide a barrier to the release of radioactive materials, provide a volume in which the core can be submerged in coolant, provide structural integrity for RVIs, maintain reactor core geometry, provide a floodable volume in which the core can be adequately cooled in the event of a breach in the RCPB external to the RV, provide correct coolant distribution, maintain RCPB, maintain the integrity of the steam dryer to assure no impact on safety functions of other components.

The LRA also lists applicable license renewal drawings that provide the details of the SSCs within the scope of license renewal and subject to an AMR.

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

2.3.1.3.1 Staff Evaluation

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

2.3.1.3.2 Conclusion

The staff reviewed the LRA and the USAR to determine whether or not the applicant failed to identify any SSCs in the RCPB that are within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has appropriately identified the RCPB components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and those subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.2 Engineered Safety Features

In LRA Section 2.3.2, the applicant identified the ESF SCs subject to an AMR for license renewal. The applicant described the supporting SCs of the ESFs in the following LRA sections:

- 2.3.2.1, “Residual heat removal (RHR)”
- 2.3.2.2, “Core Spray”
- 2.3.2.3, “Automatic Depressurization”
- 2.3.2.4, “High-pressure coolant injection (HPCI)”
- 2.3.2.5, “Reactor Core Isolation Cooling”
- 2.3.2.6, “Standby gas treatment system (SGTS)”
- 2.3.2.7, “Primary Containment”
- 2.3.2.8, “ESF Systems In Scope for 10 CFR 54.4(a)(2)”

2.3.2.1 *Residual Heat Removal System*

2.3.2.1.1 Summary of Technical Information in the Application

The RHR system consists of four main pumps, two heat exchangers, and associated piping and valves. There are two physically separated loops, each consisting of two pumps and one heat exchanger. The two separated loops prevent a single failure from causing both loops to be inoperable and thus the entire system being inoperable. The RHR system can restore and maintain the coolant inventory in the RV to cool the core in the case of a loss of coolant accident (LOCA), it can provide drywell and suppression pool cooling in post-LOCA situations and it can provide RHR when the main heat sink is unavailable (e.g., normal shutdown). RHR can operate in five modes including the low pressure coolant injection (LPCI), containment spray, suppression pool cooling, shutdown cooling, and fuel pool cooling (FPC).

The LPCI mode of RHR works to restore and maintain coolant inventory in the RV after a LOCA. LPCI operates at low reactor coolant pressures and can deliver inventory in large break LOCAs or during a small break LOCA after the automatic depressurization system (ADS) has lowered pressure to the point to allow LPCI to work. The main pumps will take suction from the suppression pool and discharge through the recirculation lines to provide coolant to the core.

The containment spray mode of RHR works to lower pressure and temperature in containment following a LOCA. The pumps pump water through the RHR heat exchangers and then use spray headers in the drywell to condense any steam that may be in containment, therefore lowering pressure and temperature. The water can then return to the suppression pool through the suppression vent pipes.

The suppression pool cooling mode of RHR is used to lower pressure in the suppression pool. The pumps take water from the suppression pool and pump it through the RHR heat exchangers and then return the cooled water below the surface of the suppression pool.

The shutdown cooling mode of RHR is a normal operating mode of RHR during reactor shutdown and cooldown. When the condenser becomes unavailable, the reactor coolant is pumped by the main RHR pumps through the RHR heat exchangers where the heat is transferred to the service water system. The cooled water is then returned to the reactor through the recirculation lines. One RHR heat exchanger is sufficient to provide cooling of decay heat.

The FPC mode of RHR can be used to support the FPC system. The system can be aligned to provide water to the fuel pool diffusers via the RHR-fuel FPC inertia. The LRA lists the intended functions of the RHR system and the applicable drawings within the scope of license renewal.

The purpose of the RHR system is to restore and maintain RV coolant inventory for adequate core cooling after a LOCA, and to provide decay heat removal during normal shutdown conditions. The RHR also provides post-LOCA cooling for the suppression pool, and spray to the drywell and suppression pool for pressure and temperature control.

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

2.3.2.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.1, USAR Sections IV-8 and VI-3, and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.1 and the guidance in SRP-LR Section 2.3. The staff's review of LRA Section 2.3.2.1 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.3.2.1-1, dated June 29, 2009, the staff requested that the applicant explain the scoping basis (safety-related versus nonsafety-related affecting safety-related) for inclusion of the drain/vent/test connection valves shown on license renewal drawing LRA-2040-SH01. Specifically, in drawing Zones B/C/D-8/9/10, valve RHR-27 is color-coded red for RCPB while the downstream pipe and valve RHR-28 are color-coded yellow (nonsafety-related affecting safety-related). RHR-29 and RHR-30 are similarly color-coded. However, RHR-24 and RHR-25 are both color-coded in red while the piping downstream of RHR-25 is color-coded yellow. In Zone C-9, drain valve RHR-297 downstream piping is color-coded red as being in-scope as safety-related. The drain lines downstream of most other drain valves are color coded yellow as being in-scope as nonsafety-related affecting safety-related. In its response dated July 29, 2009, the applicant stated that the drain piping downstream of valve RHR-297 should be highlighted yellow instead of red because it is nonsafety-related and that the piping was included as component type "piping" in LRA Table 3.2.2-8-1, "Residual Heat Removal System [10 CFR 54.4(a)(2)]." The applicant confirmed that all other color coding (scoping) on drawing LRA-2040-SH01 was correct as originally submitted.

In RAI 2.3.2.1-2, dated June 29, 2009, the staff requested that the applicant explain the scoping basis (safety-related versus nonsafety-related affecting safety-related) for inclusion of the piping between valve MO-57 and the reactor building wall. Specifically, that section of pipe is color-coded aqua/cyan for inclusion as RHR safety-related while the code boundary flag showed that section of pipe to be non-code. In its response dated July 29, 2009, the applicant stated that the piping between MO-57 and the reactor building wall should be color-coded yellow as being in-scope in accordance with 10 CFR 54.4(a)(2) and was included as component type "piping" in LRA Table 3.2.2-8-1, "Residual Heat Removal System [10 CFR 54.4(a)(2)]."

Based on its review, the staff finds the response to RAIs 2.3.2.1-1 and 2.3.2.1-2 acceptable because the applicant clarified the scoping of the items identified in the RAIs, therefore, the staff's concerns described in RAIs 2.3.2.1-1 and 2.3.2.1-2 are resolved.

2.3.2.1.3 Conclusion

The staff reviewed the LRA, USAR, license renewal boundary drawings, and RAI responses to determine whether or not the applicant failed to properly identify any components within the scope of license renewal and subject to an AMR. Based on this review, the staff concludes the applicant has appropriately identified the RHR system mechanical components subject to an AMR in accordance with 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

CS is an ECCS that cools the core by taking suction from the suppression pool and pumping the water through spray spargers above the core. The CS system has two independent loops each of which has a centrifugal pump, a spray sparger, and associated valves and piping. The CS system is designed to be used in low reactor coolant pressures such as a large break LOCA or a small break LOCA in which the ADS has lowered pressure sufficiently. The CS system can also be aligned to the condensate storage tank (CST) during refueling operations.

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

2.3.2.2.2 Staff Evaluation

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

2.3.2.2.3 Conclusion

The staff reviewed the LRA and the USAR to determine whether or not the applicant failed to identify any SSCs in the CS system within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has appropriately identified the CS system components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and those subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.2.3 *Automatic Depressurization System*

2.3.2.3.1 Summary of Technical Information in the Application

The ADS serves to lower RCS pressure as a backup to the high pressure coolant injection (HPCI) in LOCA conditions. The ADS is comprised of six of the eight safety/relief valves (S/RVs) in the MS lines located inside the drywell and before the first MSIV. The valves are nitrogen actuated and discharge to the suppression pool through discharge lines that lead to T-quenchers located at the minimum water level in the suppression pool. The remaining two of the eight S/RVs are also included in the evaluation.

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

2.3.2.3.2 Staff Evaluation

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

2.3.2.3.3 Conclusion

The staff reviewed the LRA and the USAR to determine whether or not the applicant failed to identify any SSCs in the ADS within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has appropriately identified the ADS components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and those subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.2.4 *High Pressure Coolant Injection System*

2.3.2.4.1 Summary of Technical Information in the Application

The HPCI is part of the ECCS. The main function of the HPCI system is to protect the core in the case of a small break in the RCPB which does not cause rapid depressurization. The HPCI system contains a steam turbine and a turbine driven pump. Steam is extracted from the MS lines upstream of the MSIVs to run the pump. The turbine exhaust is routed to the suppression pool. Because of this, it is capable of supplying water even during an SBO. Water suction is normally aligned to the emergency condensate storage tanks (ECSTs) but can also come from the suppression pool. The water is pumped into the RV via the FW line. There is also an LO system for HPCI which provides control oil to operate the main pump bearings, the turbine stop and control valve, and multiple other components.

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

2.3.2.4.2 Staff Evaluation

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

2.3.2.4.3 Conclusion

The staff reviewed the LRA and the USAR to determine whether or not the applicant failed to identify any SSCs in the HPCI system within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has appropriately identified the HPCI system components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and those subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.2.5 *Reactor Core Isolation Cooling System*

2.3.2.5.1 Summary of Technical Information in the Application

The reactor core isolation cooling (RCIC) system is not an ECCS system but is available to provide makeup water to the RV to provide adequate cooling and control of the RV water level. The RCIC system has a steam-driven turbine-pump and normally takes suction for the ECSTs and can take suction from the suppression pool. The water is injected into the RV via a FW line. The steam to run the pump is extracted from the MS lines upstream of the first MSIV. The steam is discharged to the suppression pool. This allows the pump to run during a SBO.

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

2.3.2.5.2 Staff Evaluation

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

2.3.2.5.3 Conclusion

The staff reviewed the LRA and the USAR to determine whether or not the applicant failed to identify any SSCs in the RCIC system within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has appropriately identified the RCIC system components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and those subject to an AMR, in accordance with 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

The purpose of the standby gas treatment system (SGTS) is to draw and process, by filtration and elevated release, the gaseous and airborne effluents from the reactor building, when required post-accident to limit the discharge of radioactive materials to the environs. The SGTS functions as part of the secondary containment.

2.3.2.6.2 Staff Evaluation

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

2.3.2.6.3 Conclusion

The staff reviewed the LRA, USAR, and license renewal boundary drawings. Based on this review, the staff concludes that there is reasonable assurance that the applicant has appropriately identified the SGTS mechanical components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and those subject to an AMR in accordance with 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

The purpose of the PC system is to maintain PC integrity post-accident to limit the release of radioactive material to the environs. PC consists of a drywell housing the RV, reactor coolant recirculation system, and branch connections; a toroidal pressure suppression pool chamber; vent lines connecting the drywell to the suppression pool; vacuum relief and containment isolation valves in various process lines.

2.3.2.7.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.7, USAR Sections V-2.0, VII-5.0, and VII-5.11, and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.1 and the guidance in SRP-LR Section 2.3. The staff's review of LRA Section 2.3.2.7 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 2.3.2.7-1, dated June 29, 2009, the staff requested that the applicant resolve the labeling identification discrepancy between license renewal boundary drawings of instrument line root valves. Specifically, drawing LRA-2084 showed an instrument line root valve from RV penetration X-40A with a label "NBI-49" while drawing LRA-2026-SH01 showed a valve labeled as "NBI-49" as being the instrument root valve for jet pump 6 flow instrumentation.

In its response dated July 29, 2009, the applicant stated that the instrument root valve labeled as "NBI-49" on drawing LRA-2084 should have been labeled "PC-49."

In RAI 2.3.2.7-2, dated June 29, 2009, the staff requested that the applicant resolve the labeling identification discrepancy between license renewal boundary drawings of instrument line root valves. Specifically, drawing LRA-2084 showed an instrument line root valve from RV penetration X-40D with a label "NBI-63" while drawing LRA-2026-SH01 showed a valve labeled as "NBI-63" as being the instrument root valve for jet pump 11 flow instrumentation.

In its response dated July 29, 2009, the applicant stated that the instrument root valve labeled as "NBI-63" on drawing LRA-2084 should have been labeled "PC-63."

In RAI 2.3.2.7-3, dated June 29, 2009, the staff requested that the applicant explain an apparent inconsistency in scoping penetration pressure monitoring instrumentation lines. Specifically, drawing LRA-2022-SH01 shows the pressure monitoring instrument line from electrical penetration X-101E not color-coded as being in-scope when the code boundary flag appeared to show this line as being in or attached to the Class 2 boundaries. In contrast, the pressure monitoring instrumentation line from the personnel airlocks were shown color-coded as being in-scope.

In its response dated July 29, 2009, the applicant stated that the pressure monitoring instrument lines from electrical penetrations are not in-scope as they are not part of the containment boundary (inboard seal of electrical penetration is containment boundary, electrical penetrations not considered double barrier) nor does the pressurization medium perform any in-scope function.

Based on its review, the staff finds the responses to RAIs 2.3.2.7-1, 2.3.2.7-2, and 2.3.2.7-3 acceptable because the applicant clarified the scoping of the items identified in the RAIs. Therefore, the staff's concerns described in RAIs 2.3.2.7-1, 2.3.2.7-2, and 2.3.2.7-3 are resolved.

2.3.2.7.3 Conclusion

The staff reviewed the LRA, USAR, license renewal boundary drawings, and RAI responses to determine whether or not the applicant failed to properly identify any components within the scope of license renewal and subject to an AMR. Based on its review, the staff concludes that the applicant has appropriately identified the PC system mechanical components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.2.8 *Engineered Safety Feature Systems In-Scope for 10 CFR 54.4(a)(2)*

2.3.2.8.1 Summary of Technical Information in the Application

Nonsafety-related portions of ESF systems may be within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) for physical interaction of nonsafety-related systems with safety-related systems related to structural support or spatial interaction. Spatial interaction includes physical impact, pipe whip, jet impingement, or causing flooding or harsh environment. Portions of the RHR system are in-scope in accordance with 10 CFR 54.4(a)(2).

2.3.2.8.2 Staff Evaluation

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

2.3.2.8.3 Conclusion

The staff reviewed the LRA, USAR, and the license renewal boundary drawings. Based on this review, the staff concludes that there is reasonable assurance that the applicant has appropriately identified the nonsafety-related RHR system mechanical components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and those subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3 Auxiliary Systems

In LRA Section 2.3.3, the applicant identified the auxiliary systems SCs within the scope of license renewal and subject to an AMR. The applicant described the supporting SCs of the auxiliary systems in LRA Sections 2.3.3.1 through 2.3.3.14.

The staff identified several LRA drawings where the continuation from one drawing to another could not be established. These drawings were LRA drawings: 2006-Shs 1 and 4, 2027-Sh 1, 2007, 2005-Sh 2, 2013, 2004-Sh 1, 2042-Sh 3, and 2049-Sh 3. Therefore, the staff submitted RAI 2.3.3-1 dated July 16, 2009, identifying each continuation discrepancy in the above listed LRA drawings and asking the applicant to provide sufficient information for each continuation discrepancy to permit the staff to review all portions of the system within the license renewal boundary.

In response to RAI 2.3.3-1, dated August 16, 2009, the applicant satisfactorily supplied all the information needed for the staff to complete its review. The staff finds the applicant's response to RAI 2.3.3-1 acceptable.

2.3.3.1 *Standby Liquid Control*

2.3.3.1.1 Summary of Technical Information in the Application

The SLC system is a backup system that is independent of the control rods. It is capable of bringing the reactor power to cold shutdown. The SLC consists of a storage tank, two positive displacement pumps, two explosive valves, a test tank, and associated piping and valves. The system takes suction from the storage tank and pumps borated water directly into the RV near the bottom of the core shroud. The boron acts as a neutron absorber and shuts down the reactor.

The SLC acts as a special system in case the control rods are not inserted when necessary, known as ATWS.

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

2.3.3.1.2 Staff Evaluation

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

2.3.3.1.3 Conclusion

The staff reviewed the LRA and the USAR to determine whether or not the applicant failed to identify any SSCs in the SLC system within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has appropriately identified the SLC system components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and those subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.2 *Control Rod Drive*

2.3.3.2.1 Summary of Technical Information in the Application

The control rod drive (CRD) system consists of control rod blades, the control rod drive mechanisms (CRDMs), and the components, piping, and valves of the CRD hydraulic system. The control rod is positioned in the core by the CRDMs to provide reactivity control in the core. In case it is necessary, the CRD system is designed to rapidly insert the control rod into the core to protect the fuel barrier.

The CRD housings are welded to the bottom head of the RV. The rods can be positioned in the core using the hydraulic controls. This allows precise stepping and monitoring of the control rod. Scram accumulators use water backed by nitrogen pressure to rapidly insert the control rods into the core. At high pressure, the RCS will assist in inserting the rod through a ball check valve.

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

2.3.3.2.2 Staff Evaluation

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

2.3.3.2.3 Conclusion

The staff reviewed the LRA and the USAR to determine whether or not the applicant failed to identify any SSCs in the CRD system within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has appropriately identified the CRD system components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and those subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.3 *Service Water*

2.3.3.3.1 Summary of Technical Information in the Application

The service water (SW) system provides a heat sink for the reactor equipment cooling (REC) system (LRA Section 2.3.3.11), RHR system (LRA Section 2.3.2.1), and DG cooling systems (LRA Section 2.3.3.4) under transient and accident conditions, and provide a heat sink for systems cooled by the REC and turbine equipment cooling (TEC) systems (LRA Section 2.3.3.14, “Turbine Equipment Cooling”) during planned operations, as well as supplying the residual heat removal service water (RHRSW) booster pumps during RHR system operation for shutdown cooling. The RHRSW booster pumps provide cooling to the RHR system. The booster pumps maintain SW pressure greater than RHR system pressure to prevent an uncontrolled release in the event of an RHR heat exchanger tube failure after a DBE.

2.3.3.3.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.3, USAR Sections X-8.0 and X-3.6.3, and the license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.3.3.3.SW-1, dated July 16, 2009, the staff noted that license renewal drawing LRA-2006-SH04, Zone J-6, identifies the "CONTROL BLDG. BASEMENT VENTILATOR" as within the scope of license renewal in accordance with 10 CFR 54.4(a)(2) and subject to an AMR but not included in Table 2.3.3-3, the list of component types subject to an AMR. The staff requested that the applicant provide the basis for not including the "CONTROL BLDG. BASEMENT VENTILATOR" in Table 2.3.3-3.

In its response dated August 17, 2009, the applicant stated that the "CONTROL BLDG. BASEMENT VENTILATOR" is included in LRA Table 2.3.3-14-11 as "Fan housing."

Based on its review, the staff finds the response to RAI 2.3.3.3.SW-1 acceptable because the applicant identified that the "CONTROL BLDG. BASEMENT VENTILATOR" is included in Table 2.3.3-14-11, the table listing heating and ventilation (HV) component types subject to an AMR.

In RAI 2.3.3.3.SW-2, dated July 16, 2009, the staff noted that in license renewal drawing LRA-2036-SH01, Zone D-2, the line downstream of valve SW-139 is not highlighted as within the scope of license renewal in accordance with 10 CFR 54.4(a)(1) or (a)(3) up through the disconnects, while similar lines are identified as within the scope of license renewal and subject to an AMR. The staff requested that the applicant provide a basis for not including the line downstream of valve SW-139 within the scope of license renewal and subject to an AMR.

In its response dated August 17, 2009, the applicant stated the line downstream of valve SW-139 is within the scope of license renewal in accordance with 10 CFR 54.4(a)(1) and is subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.3.SW-2 acceptable because the applicant stated the line in question is within the scope of license renewal in accordance with 10 CFR 54.4(a)(1).

2.3.3.3.3 Conclusion

The staff reviewed the LRA, USAR, RAI responses, and license renewal drawings to determine whether or not the applicant failed to identify any components within the scope of license renewal. In addition, the staff determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes the applicant has appropriately identified the SW system mechanical components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and that the applicant has appropriately identified the SW system mechanical components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.4 *Diesel Generator*

2.3.3.4.1 Summary of Technical Information in the Application

LRA Section 2.3.3.4 describes the DG system, which provides a single failure proof alternating current power supply to safely shutdown the reactor during and following DBEs. The DG system consists of two independent DGs, each with its own supporting auxiliary systems. The auxiliary supporting systems are the diesel generator fuel oil (DGFO) system (reviewed in Section 2.3.3.5), diesel generator jacket water (DGJW), diesel generator lube oil (DGLO), and the diesel generator starting air (DGSA). The DGJW provides sufficient cooling water to the diesel engine. The DGLO provides circulating oil to lubricate and cool the moving parts of the diesel engine. The DGSA stores and provides compressed air to start the DG.

The DG, DGJW, DGLO, and DGSA systems contain safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the DGJW and DGSA systems potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the DG, DGJW, DGLO, and DGSA systems perform functions that support fire protection. LRA Tables 2.3.3-4, 2.3.3-14-6, and 2.3.3-14-7 identify the DG system component types within the scope of license renewal and subject to an AMR.

2.3.3.4.2 Staff Evaluation

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

2.3.3.4.3 Conclusion

Based on the results of the staff evaluation discussed in Section 2.3 and on a review of the LRA, USAR, and applicable boundary drawings, the staff concludes that the applicant has appropriately identified the DG, DGJW, DGLO, and DGSA systems mechanical components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and that the applicant has appropriately identified the system components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.5 *Fuel Oil*

2.3.3.5.1 Summary of Technical Information in the Application

LRA Section 2.3.3.5 describes the fuel oil system which encompasses the DGFO and the fuel portion of the fire protection system. The DGFO system stores and transfers clean fuel oil for the DGs. The DGFO system contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the DGFO system could potentially prevent the satisfactory accomplishment of a safety-related function. In addition, the DGFO system and the fuel oil portion of the fire protection system each perform functions that support fire protection. LRA Tables 2.3.3-5 and 2.3.3.14-5 identify fuel oil system component types within the scope of license renewal and subject to an AMR.

2.3.3.5.2 Staff Evaluation

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

2.3.3.5.3 Conclusion

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

2.3.3.6 *Fire Protection – Water*

2.3.3.6.1 Summary of Technical Information in the Application

The fire protection system provides fire protection capability to CNS. The fire protection-water system is a subsystem of the fire protection system. Fire protection Halon and CO_2 systems and components of the fire protection system are listed in LRA Section 2.3.3.7 . Other components of the fire protection program are listed elsewhere in the LRA: smoke and heat ventilation systems with the heating and ventilation systems (LRA Section 2.3.3.8), detectors with the EIC evaluation, and fire barriers and fire stops with structural reviews. Fuel oil components associated with the diesel fire pump are reviewed in LRA Section 2.3.3.5, “Fuel Oil.”

2.3.3.6.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.6, USAR Sections X9.0 and X18.0, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and USAR to verify that the applicant had not omitted from the scope of license renewal any components with intended functions in accordance with 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant had not omitted any passive or long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

The staff also reviewed the CNS fire protection CLB documents listed in the Operating License Condition 2.C(4). This review included CNS commitments to 10 CFR 50.48, “Fire protection” (i.e., approved fire protection program), as provided in the responses to Appendix A to the Branch Technical Position (BTP), Auxiliary and Power Conversion Systems Branch (APCSB), 9.5-1, “Guidelines for Fire Protection for Nuclear Power Plants,” May 1, 1976, documented in the following SERs: November 29, 1977; May 23, 1979; November 21,1980; April 29, 1983; April 16, 1984; June 1,1984; January 3, 1985; August 21, 1985; April 10, 1986; September 9, 1986; November 7, 1988; February 3, 1989; August 15, 1995; and July 31, 1998.

During its review of LRA Section 2.3.3.6, the staff identified areas in which additional information was necessary to complete its review of the applicant’s scoping and screening results. The applicant responded to the staff’s RAIs as discussed below. In RAI 2.3.3.6-1, dated June 29, 2009, the staff requested additional information related to the clean water fire protection system that the applicant referred to in Section 2.1, “Fire Protection System Clean Water Supply,” of the SER dated April 29, 1983, where the licensee stated that a “clean water fire protection system is being installed at CNS which upgrades the existing system that takes suction from the Missouri River….” LRA drawing LRA-2016-SH01A-0 shows the water treatment system as being within the scope of license renewal and subject to an AMR. This drawing shows the 15,000-gallon fire system flushing tank and associated components at locations A10, A11, B10, and B11 as out of scope (i.e., not colored in red). The staff requested that the applicant verify whether the 15,000-gallon fire system flushing tank and associated components 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). If they are not within the scope of license renewal and not subject to an AMR, the staff requested that the applicant provide justification for the exclusion. In its response dated July 29, 2009, the applicant stated that, as indicated in LRA Section 2.3.3.6, the dedicated clean water supply for fire protection is provided by two 500,000-gallon tanks. These tanks are the only fire water supply tanks credited for 10 CFR 50.48 requirements. The flushing tank shown on drawing LRA-2016-SHO1A-0 contains treated water that is used to flush the fire water system should the screen wash pumps or the backup electric fire pump (1C), which use river water, be used to supply fire water. Use of these backup river water sources is not in accordance with 10 CFR 50.48. The 15,000-gallon flushing tank and its associated components are not in accordance with 10 CFR 50.48 requirements and have no other functions that meet 10 CFR 54.4(a) scoping requirements and are therefore not within the scope of license renewal.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.6-1 acceptable. The 15,000-gallon fire system flushing tank and associated components are properly shown in license renewal drawing LRA-2016-SH01A-0 as not within the scope of license renewal. The tank and associated components in question are not credited to meet the requirements of 10 CFR 50.48. The license renewal drawing correctly left un-highlighted the 15,000-gallon fire system flushing tank and associated components. The staff confirmed that, although a third electric fire pump is addressed in the May 23, 1979, SER, it is not relied on for compliance with 10 CFR 50.48, because this takes suction directly from the Missouri River and provides a backup supply to the fire water system. The fire water system at CNS includes two 500,000-gallon water tanks. The tanks supply water to two fire pumps located in the fire pump house, one electric-driven and one diesel-driven. Therefore, since there is no intended function associated with 10 CFR 54.4(a)(2), the 15,000-gallon fire system flushing tank and associated components were correctly excluded from the scope of license renewal and are not subject to an AMR. Therefore, the staff’s concern described in RAI 2.3.3.6-1 is resolved.

In RAI 2.3.3.6-2, dated June 29, 2009, the staff stated that license renewal drawing LRA-2016-SH02-0 shows fire water system valves and nozzles at locations F9, G10, and H9 as out of scope (i.e., not colored in red). The staff requested that the applicant verify whether or not the above fire hose connections 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). If these hose connections are excluded from the scope of license renewal and not subject to an AMR, the staff requested that the applicant provide justification for the exclusion.

In its response dated July 29, 2009, the applicant stated that the non-highlighted fire water piping, valves, nozzles, and associated components shown on drawing LRA-2016-SH02-0 (coordinates F9, G10, and H9) are normally isolated from the remainder of the fire water system and are part of the test headers used for system and component testing. They do not provide a function that supports fire water system 10 CFR 50.48 requirements and are therefore not within the scope of license renewal.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.6-2 acceptable. Because the fire protection SSCs (piping, valves, nozzles, and associated components) in question are normally isolated from the remainder of the fire water system and are parts of the test headers used for system and component testing, the staff concludes that the fire protection systems and components were correctly excluded from the scope of license renewal and from being subject to an AMR, because these components are not needed to support the fire protection system intended function. Therefore, the staff determined that RAI 2.3.3.6-2 is resolved.

In RAI 2.3.3.6-3, dated June 29, 2009, the staff stated that, according to Section 4.3.1.4, "Interior Hose Stations," of the SER dated May 23, 1979, "54 interior stations are strategically located throughout the plant…." The staff requested that the applicant verify whether all 54 hose stations 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). If any are excluded from the scope of license renewal and not subject to an AMR, the staff requested that the applicant provide justification for the exclusion (the staff reviewed information in SER dated May 23, 1979 to verify if any applicable items are excluded from the scope of license renewal, which would require justification for exclusion).

In its response dated July 29, 2009, the applicant stated there are 64 interior stations strategically placed throughout the plant (where safety-related equipment is located) that are within the scope of license renewal, and 24 stations that are not within the of scope of license renewal. The 24 stations not within the scope of license renewal are located in areas such as outbuildings (e.g., warehouses, security building, communication building, and training building) and office buildings that are not required to meet 10 CFR 50.48 requirements.

In evaluating this response, the staff found that it was incomplete and that review of LRA Section 2.3.3.6 could not be completed (the information contained in the response was insufficient for the staff's review). Although it mentions that the 64 interior hose stations are within the scope of license renewal, locations of these hose stations in various areas of the plant were not clear. This resulted in the staff holding a telephone conference with the applicant on August 6, 2009 to discuss information necessary to resolve the concern in RAI 2.3.3.6-3. The applicant was asked to verify the location of 64 interior hose stations and to identify where they are shown on the LRA drawings. In its response, the applicant stated that the 64 interior hose stations in question are highlighted on license renewal drawings showing that they are within the scope of license renewal, in accordance with 10 CFR 54.4(a), and are subject to an AMR, in accordance with 10 CFR 54.21(a). The applicant provided LRA drawing numbers, locations of interior hose stations, and the associated manual isolation valves, as shown below.

<u>Turbine Generator Building</u>. LRA drawing 2016-SH01-0:

- HV-1 FP-301
- HV-2 FP-303
- HV-3 FP-299
- HV-4 FP-310
- HV-5 FP-302
- HV-6 FP-308
- HV-7 FP-309
- HV-8 FP-300
- HV-9 FP-298
- HV-10 FP-305
- HV-11 FP-297
- HV-12 FP-304

- HV-13 FP-307
- HV-14 FP-295
- HV-20 FP-296
- HV-21 FP-306
- HV-22 FP-311
- HV-60 FP-487

Instrument Storage. LRA drawing 2016-SH01B-0:

- HV-16 FP-315
- HV-17 FP-314
- HV-19 FP-312

Control Building. LRA drawing 2016-SH01B-0:

- HV-18 FP-313

Office Building. LRA drawing 2016-SH01B-0:

- HV-30 FP-327
- HV-47 FP-323
- HV-61 FP-547
- HV-64 FP-555

Augmented Radwaste Building. LRA drawing 2016-SH01B-0:

- HV-51 FP-457
- HV-52 FP-458
- HV-53 FP-459
- HV-54 FP-460
- HV-55 FP-461

Radwaste Building. LRA drawing 2016-SH01B-0:

- HV-23 FP-316
- HV-24 FP-321
- HV-25 FP-318
- HV-28 FP-317
- HV-29 FP-322
- HV-49 FP-320
- HV-50 FP-319

Reactor Building. LRA drawing 2016-SH01C-0:

- HV-31 FP-333
- HV-32 FP-329

- HV-33 FP-331
- HV-34 FP-334
- HV-35 FP-332
- HV-36 FP-328
- HV-37 FP-335
- HV-38 FP-330
- HV-39 FP-337
- HV-40 FP-338
- HV-41 FP-342
- HV-42 FP-336
- HV-43 FP-339
- HV-44 FP-340
- HV-45 FP-341
- HV-46 FP-343
- HV-56 FP-479
- HV-57 FP-480
- HV-58 FP-481
- HV-59 FP-482
- HV-62 FP-549
- HV-63 FP-548

Multi-Purpose Facility. LRA drawing 2016-SH06-0:

- HV-71 FP-792
- HV-72 FP-791
- HV-73 FP-790
- HV-74 FP-830

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.6-3 acceptable (relative to the potential applicable items in the SER dated May 23, 1979). The applicant installed more interior hose stations after 1979, bringing the total to 88 hose stations. Out of the originally cited 54 in question, 24 hose stations are for the warehouses, security building, communication building, and training building. These facilities are separated from the plant power block. The staff has confirmed that the applicant correctly identified 64 interior hose stations subject to an AMR and an additional 24 hose stations are correctly excluded from the scope of license renewal and not subject to an AMR. Therefore, the staff’s concern described in RAI 2.3.3.6-3 is resolved.

In RAI 2.3.3.6-4, dated June 29, 2009, the staff indicated that, according to Section 4.3.1.6, “Foam Suppression System,” of the SER dated May 23, 1979, “the applicant will provide an automatic foam suppression system over the diesel fire pump in the intake structure and manual foam capability to include inductors and foam concentration in a readily available location.” The staff requested that the applicant verify whether or not the automatic foam suppression system over the diesel fire pump is within the scope of license renewal, in accordance with 10 CFR 54.4(a) and subject to an AMR, in accordance with 10 CFR 54.21(a)(1). If the automatic foam suppression system and associated components are excluded from the scope of license renewal and not subject to an AMR, the staff requested that the applicant provide justification for the exclusion.

In its response dated July 29, 2009, the applicant stated that there is no longer a diesel fire pump or an associated automatic foam suppression system in the intake structure. The diesel fire pump in the intake structure was removed (as authorized by License Amendment 82, dated April 29, 1983) to comply with the requirements of 10 CFR 50 Appendix R. The foam suppression system was also removed since it was no longer required with the removal of the diesel fire pump.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.6-4 acceptable. The staff reviewed the SER dated April 29, 1983, and confirmed that the diesel fire pump in the intake structure was removed, as well as the automatic foam suppression system. Therefore, the staff's concern described in RAI 2.3.3.6-4 is resolved.

In RAI 2.3.3.6-8, dated June 29, 2009, the staff stated that, according to LRA Section 2.3.3-6:

> The FP [fire protection] – water system includes water storage tanks, one diesel-driven 3,000 [gallons per minute] (gpm) fire pump, one electric-driven 3,000 gpm fire pump, one 30 gpm jockey fire pump…Two above-ground fire protection water storage tanks, each having a gross capacity of 500,000 gallons of water, provide the dedicated water supply of fire protection use…The tanks supply water to two fire pumps located in the fire pump house, one electric-driven and one diesel-driven. A third fire pump takes suction directly from the Missouri River and provides a backup supply to the system…

LRA Section 2.3.3.6 discusses requirements for the fire water supply system but does not mention trash racks and traveling screens for the backup fire pump suction water supply. Trash racks and traveling screens are typically located upstream of the fire pump suctions to remove any major debris from the fresh or raw water to prevent clogging of the fire protection water supply system. Trash racks and traveling screens are typically considered to be passive, long-lived components. Both the trash racks and traveling screens are located in a fresh or raw water/air environment and are typically constructed of carbon steel. Carbon steel in a fresh or raw water environment or water/air environment is subject to loss of material, pitting, crevice formation, and microbiologically influenced corrosion and fouling. The staff requested that the applicant explain the apparent exclusion of the trash racks and traveling screens that are located upstream of the fire pump suctions from 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).

In its response dated July 29, 2009, the applicant stated that the safety evaluation for License Amendment 82, dated April 29, 1983, approved the upgrade of the electric and diesel-driven fire pump suctions from the Missouri River to a clean water source, and established the as-modified system as the basis for compliance with 10 CFR 50, Appendix R and BTP 9.5-1 Appendix A. The third fire pump is a non-credited backup to these fire pumps. Having no 10 CFR 54.4 (a)(1), (a)(2), or (a)(3) functions, it is not within the scope of license renewal. Thus the associated nonsafety-related components (e.g., trash racks and traveling screens) that support the third fire pump are also 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 2.3.3.6-8 acceptable. The fire water system at CNS is supplied from two dedicated above-ground fire protection water storage tanks, each having a gross capacity of 500,000 gallons. The applicant explained that trash racks and traveling screens for the backup fire pump suction water supply are not credited for any fire protection intended function, because fire water system supply is from tanks and not from the Missouri River. Therefore, these are properly excluded from the scope of license renewal and not subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.6-8 is resolved.

2.3.3.6.3 Conclusion

The staff reviewed the LRA, USAR, RAI responses, and license renewal drawings to determine whether or not the applicant properly identified all fire protection system components within the scope of license renewal. In addition, the staff sought to determine whether or not the applicant properly identified all fire protection system components subject to an AMR. On the basis of its review, the staff concludes that the applicant has appropriately identified the fire protection system components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and those subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.7 *Halon and CO_2*

2.3.3.7.1 Summary of Technical Information in the Application

The gaseous fire protection systems provide fire protection capability to CNS.

The fire protection system includes two Halon systems, one each for the service water pump room and the computer room in control building. Both systems are designed with a reserve tank for back-up; however, the computer room is not required for safe-shutdown and its Halon system has no intended function for license renewal.

A high-pressure CO2 fire protection system is provided for each diesel generator room. In addition, a separate low-pressure CO_2 bulk storage tank supplies protection for the turbine bearing and to hand hose stations located at the Control Room entrance, in the Cable Spreading Room, in the Non-Critical Switchgear area, and in the Motor generator Set are of the Reactor Building

2.3.3.7.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.7, USAR Sections X9.0 and X18.0, and license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and USAR to verify that the applicant had not omitted from the scope of license renewal any components with intended functions in accordance with 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant had not omitted any passive or long-lived components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

The staff also reviewed the CNS fire protection CLB documents listed in the Operating License Condition 2.C(4). This review included CNS commitments to 10 CFR 50.48, "Fire protection" (i.e., approved fire protection program), as provided in the responses to Appendix A to the BTP, APCSB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants," May 1, 1976, documented in the following SERs: November 29, 1977; May 23, 1979; November 21,1980; April 29, 1983; April 16, 1984; June 1,1984; January 3, 1985; August 21, 1985; April 10, 1986; September 9, 1986; November 7, 1988; February 3, 1989; August 15, 1995; and July 31, 1998.

In LRA Section 2.3.3.7, the applicant listed applicable license renewal drawings for the Halon and CO_2 systems. The drawings are highlighted to identify those portions of the system that are within the scope of license renewal. The staff compared the LRA drawings to the system descriptions in the USAR and NRC safety evaluation reports listed in the CNS CLB to ensure that they were representative of the Halon and CO_2 systems. To verify that the applicant included the applicable portions of the Halon and CO_2 system within the scope of license renewal, the staff focused its review on those portions of the Halon and CO_2 systems that were not identified as within the scope of license renewal and confirmed that they did not meet the scoping criteria of 10 CFR 54.4(a).

The staff confirmed that the Halon and CO_2 systems associated components are included in LRA Table 2.3.3-7 as subject to an AMR. The staff confirmed that these components are highlighted in the LRA drawings. On the basis of the information in the LRA drawings USAR, and CLB documents the staff did not identify any omissions by the applicant in scoping of the Halon and CO_2 systems and components according to 10 CFR 54.4(a).

2.3.3.7.3 Conclusion

The staff reviewed the LRA, USAR, and license renewal drawings to determine whether or not the applicant properly identified all fire protection system component within the scope of license renewal. In addition, the staff sought to determine whether or not the applicant properly identified all fire protection system components subject to an AMR. On the basis of its review, the staff concludes that the applicant has appropriately identified the fire protection system components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and those subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.8 *Heating, Ventilation, and Air Conditioning*

2.3.3.8.1 Summary of Technical Information in the Application

The purpose of the HV system is to provide air to areas of the station that are adequately conditioned to support personnel occupancy and proper operation of equipment.

The HV system includes the following subsystems:

- reactor building heating, ventilation, and air conditioning (HVAC)
- PC HVAC
- secondary containment ventilation
- control building HVAC
- main control room emergency filter system
- DG HVAC
- turbine building HVAC
- intake structure HVAC
- fire pump house HVAC system

2.3.3.8.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.8, USAR Section X-10, and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.1 and the guidance in SRP-LR Section 2.3. 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 to the staff's RAIs as discussed below.

In RAI 2.3.3.8-1, dated June 29, 2009, the staff requested that the applicant explain the basis for drawing LRA-2024-SH02 not color coding the heating and ventilation units 1-HV-DG-1A and 1-HV-DG-1B enclosures, and inlet and outlet ducting and dampers as within the scope of license renewal. The USAR description indicates that these units are normally operating but does not indicate that they are shutoff when the larger diesel room HV units start. The drawing indicates that the ventilation system discharge flow is the sum of the large and small HV units.

In its response dated July 29, 2009, the applicant stated that the smaller HV units were not credited for maintaining acceptable DG room temperatures when the diesels were operating and that a failure of the smaller nonsafety-related HV units and associated ducting and dampers could not prevent the larger HV units from performing their safety-related function.

In RAI 2.3.3.8-2, dated June 29, 2009, the staff requested that the applicant explain the basis for drawing LRA-2024-SH02 not color coding the cooling coil condensation/leakage drain line from the heating and ventilation unit 1-HV-DG-1D while the similar drain line for the sister unit 1-HV-DG-1C was color-coded as being within the scope of license renewal due to nonsafety-related affecting safety-related.

In its response dated July 29, 2009, the applicant stated that the drain line from the heating and ventilation unit 1-HV-DG-1D was within the scope of license renewal and subject to an AMR for 10 CFR 54.4(a)(2). The applicant further indicated that it should be highlighted accordingly and is included in the component type of “piping” in Table 3.3.2-14-11, “Heating and Ventilation System [10 CFR 54.4(a)(2)].”

In RAI 2.3.3.8-3, dated June 29, 2009, the staff requested that the applicant verify that the battery room’s non-essential exhaust subsystem shown in Zones H/J-6/7 of drawing LRA-2018 is not within the scope of license renewal. The concern was that some sort of failure of the ducting/dampers in the non-essential subsystem could result in a diversion/disruption of adequate airflow in the essential control building HVAC system.

In its response dated July 29, 2009, the applicant stated that a failure of the battery rooms’ non-essential exhaust subsystem could not prevent the essential control building HV system from performing its safety function.

Based on its review, the staff finds the responses to RAIs 2.3.3.8-1, 2.3.3.8-2, and 2.3.3.8-3 acceptable because the applicant clarified the scoping of the items identified in the RAIs. Therefore, the staff’s concerns described in RAIs 2.3.3.8-1, 2.3.3.8-2, and 2.3.3.8-3 are resolved.

2.3.3.8.3 Conclusion

The staff reviewed the LRA, USAR, license renewal boundary drawings, and RAI responses to determine whether or not the applicant failed to properly identify any components within the scope of license renewal and subject to an AMR. Based on its review, the staff concludes that the applicant has appropriately identified the HVAC system mechanical components subject to an AMR in accordance with 10 CFR 54.21(a)(1).

2.3.3.9 *Fuel Pool Cooling and Cleanup*

2.3.3.9.1 Summary of Technical Information in the Application

LRA Section 2.3.3.9 describes the fuel pool cooling and cleanup (FPC) system. The FPC system maintains a specified spent fuel pool water temperature, purity, clarity, and water level. The FPC system consists of two parallel trains, each consisting of a circulating pump, heat exchanger, filter demineralizer, piping, valves, and instrumentation. LRA Section 2.3.3.9 also describes the tools and servicing equipment (TSE) system. The TSE system provides servicing equipment including the spent fuel racks. The TSE system contains safety-related components that are relied upon for criticality protection. LRA Table 2.3.3-9 identifies TSE component types within the scope of license renewal and subject to an AMR. The failure of nonsafety-related SSCs in the FPC system potentially could prevent the satisfactory accomplishment of a safety-related function. LRA Tables 2.3.3-9 and 2.3.3-14-10 identify the FPC system component types within the scope of license renewal and subject to an AMR.

2.3.3.9.2 Staff Evaluation

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

2.3.3.9.3 Conclusion

Based on the results of the staff's evaluation discussed in Section 2.3 and on a review of the LRA, USAR, and applicable license renewal boundary drawings, the staff concludes that the applicant has appropriately identified the FPC and TSE systems mechanical component within the scope of license renewal, in accordance with 10 CFR 54.4(a), and that the applicant has appropriately identified the system components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.10 *Service and Instrument Air*

2.3.3.10.1 Summary of Technical Information in the Application

LRA Section 2.3.3.10 describes the instrument air (IA) system and the service air (SA) system. The SA system provides a continuous source of oil free compressed air for the stations compressed air needs. The IA system receives air from the SA system and utilizes air dryers and filters to provide high quality dry air to the noncritical instrument air headers and the reliable air header which provides a continuous supply of dry filtered air to critical instrumentation and control equipment.

The IA system contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the IA system potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the IA system performs functions that support fire protection and SBO. LRA Tables 2.3.3-10 and 2.3.3-14-12 identify the IA system component types within the scope of license renewal and subject to an AMR.

The SA system contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the SA system potentially could prevent the satisfactory accomplishment of a safety-related function. LRA Tables 2.3.3-10 and

2.3.3-14-25 identify the SA system component types within the scope of license renewal and subject to an AMR.

2.3.3.10.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.10, USAR Section X-12.0, and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff identified areas in which additional information was necessary to complete the review.

The staff noted that drawing 2010 SH 1, “Flow Diagram Instrument Air Control & Turbine Building,” shows fire protection air accumulators, for fire protection systems 5, 14, 8, 9, 10, 11, 1A & 7, 21, 15, 16, 17, 18, 19, and 20 among others. The accumulators and associated supply air piping and valve bodies are not shown as subject to an AMR, in accordance with 10 CFR Parts 54.4 (a)(3) and 54.21. Therefore, the staff submitted RAI 2.3.3.10 IA-1 asking the applicant to explain why the above described components are not shown as subject to an AMR and listed in the appropriate tables of the LRA.

In its response to RAI 2.3.3.12 IA-1, dated November 30, 2009, the applicant stated that these fire protection air accumulators and associated piping either provide a constant back pressure on the deluge system trip diaphragm to prevent inadvertent actuation or provide pressure between the closed sprinkler heads and deluge trip diaphragm to monitor system integrity. These functions are not required to perform the intended functions of supplying water for fire suppression and therefore have no license renewal intended function and are not subject to an AMR. System 1A shown on LRA drawing 2016-SH01 is a wet pipe system and does not have air accumulators or associated air supply piping and valves.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.12 IA-1 acceptable because it identified the fire protection air accumulators and associated piping as not required to perform the intended functions of supplying water for fire suppression and therefore not subject to an AMR.

The staff noted that LRA drawing 2022 SH 1, “Flow Diagram Primary Containment Cooling and Nitrogen Inerting System,” shows a ½-inch pipe at location A-6 to be within the scope of license renewal and subject to an AMR and continuing on LRA drawing 117C3317 SH 2. LRA drawing 117C3317 SH 2 is not in the LRA, so the staff cannot determine whether or not the applicant has appropriately considered the continuation of the piping on this drawing to be within the scope of license renewal and subject to an AMR, in accordance with 10 CFR Parts 54.21 and 54.4. Therefore, the staff submitted RAI 2.3.3.10 IA-2 stating that the applicant needs to identify the above described piping and determine whether or not the piping is within the scope of license renewal and subject to an AMR, and revise the LRA accordingly.

In its response to RAI 2.3.3.10 IA-2, dated November 30, 2009, the applicant stated:

> Though not shown on an LRA drawing, the passive mechanical components represented on instrument detail drawing 117C3317, Sheet 2 are rack mounted components supporting instrumentation for the nitrogen gas system. These components are in scope and subject to aging management review based on the criterion of 10 CFR 54.4(a)(2) and are listed as component types “flow indicator,” “tubing,” and “valve body” in LRA Table 2.3.2-8-6, “Primary Containment System.”

Based on its review, the staff finds the applicant's response to RAI 2.3.3.10 IA-2 acceptable because it identified the components on LRA drawing 117C3317 as instrumentation for the nitrogen gas system and that these components are in scope and subject to an AMR based on the criterion of 10 CFR 54.4(a)(2) and that the component types are listed in LRA Table 2.3.2-8-6.

2.3.3.10.3 Conclusion

The staff reviewed the LRA, USAR, RAI responses, and LRA boundary drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. In addition, the staff's review determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes that the applicant has appropriately identified the instrument air system mechanical components within the scope of license renewal in accordance with 10 CFR 54.4(a), and the applicant has appropriately identified the instrument air system mechanical components subject to an AMR in accordance with 10 CFR 54.21(a)(1).

2.3.3.11 *Reactor Equipment Cooling*

2.3.3.11.1 Summary of Technical Information in the Application

LRA Section 2.3.3.11 describes the reactor equipment cooling (REC) system, which provides cooling to safety-related and nonsafety-related plant equipment. Cooling water required for safety-related systems is supplied to the RHR pump seal water coolers and to room cooling for the ECCS areas: the equipment area cooling (EAC) system cooling coils in each of the reactor building corners and the EAC system cooling coil in the HPCI room. Cooling is provided to nonsafety-related equipment in the drywell, reactor building, control building, radwaste building, and augmented radwaste building during normal planned station operations. Nonsafety-related components of the system whose failure could prevent satisfactory accomplishment of safety functions [10 CFR 54.4(a)(2)] not included in other reviews are reviewed with auxiliary systems in-scope for (a)(2) (LRA Section 2.3.3.14). Remaining REC system components are reviewed as listed in two tables: Table 2.3.3-11 lists the component types that require an AMR and Table 3.3.2-11 provides the results of the AMR.

2.3.3.11.2 Staff Evaluation

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

2.3.3.11.3 Conclusion

The staff reviewed the LRA, USAR, and license renewal drawings to determine whether or not the applicant failed to identify any components within the scope of license renewal. In addition, the staff's review determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes that the applicant has appropriately identified the REC system mechanical components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and that the applicant has appropriately identified the REC system mechanical components subject to an AMR, in accordance with 10 CFR 54.2(a)(1).

2.3.3.12 *Plant Drains*

2.3.3.12.1 Summary of Technical Information in the Application

LRA Section 2.3.3.12 describes the plant systems that are comprised of equipment and floor drainage components that handle both normal and radioactive drainage. The drainage components are found in the following plant systems: floor drains, non-radioactive (FDN); radioactive waste (RW); air removal (AR); OG; and the fuel pool cooling and cleanup (FPC). Plant drain components provide a path for flood water, maintain the integrity of secondary containment via loop seals, improve the control room pressurization boundary via loop seals, control leakage past the primary and secondary barriers in an event of flooding, and provide drainage support for safety-related systems.

2.3.3.12.2 Staff Evaluation

During the plant walkdown, the staff noted that there was turbine building roof drain piping located in areas of the plant containing SSCs within the scope of license renewal in accordance with 10 CFR 54.4(a)(1). In addition to the turbine building roof drains, the staff noted there was black drain piping on the back wall in the emergency battery room, which could not be positively identified as to which system it belonged to, and if it was properly identified as within the scope of license renewal. The staff could not identify an LRA section describing the roof drains or license renewal drawings that show the flow path of the roof drains except for license renewal drawing 2038 SH 1, which shows some reactor building roof drains. Section 54.21 of 10 CFR requires each applicant to describe and justify the methods used to identify and list those SCs subject to an AMR. Additionally, the LRA does not mention any roof drains other than those depicted on license renewal drawing 2038 SH 1. Many buildings, which may have internal roof drain piping, contain SSCs within the scope of 10 CFR 54.4 (a)(1). None of this piping is accounted for in the LRA. Therefore, the staff submitted RAI 2.3.3.12 PD-4 asking the applicant to justify the exclusion of this piping from the scope of license renewal as required by 10 CFR 54.4(a)(2) and subject to an AMR. In addition, the applicant needs to identify all roof drains for every building that contains SSC that are within the scope of license renewal in accordance with 10 CFR 54.4(a)(1) and show which roof drain piping is and is not within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2).

In its response to RAI 2.3.3.12 PD-4, dated November 30, 2009, the applicant stated:

> The roof drain components are assigned to the non-radioactive drain system. Plant walkdowns were used to identify the roof drain components and their locations in buildings containing 10 CFR 54.4(a)(1) SSCs.
>
> All piping and piping components associated with the turbine building roof drains are in scope and subject to aging management review based on the criterion of 10 CFR 54.4(a)(2). The components are listed as component types “bolting” and “piping” in LRA Table 2.3.3-14-9, “Floor Drains, Nonradioactive System.”
>
> The drain pipe on the back wall in the emergency battery room is a waste water pipe assigned to the potable water system routed from the lavatory facilities located on elevation 932' near the control room in the control building. These

> components are listed as component types bolting and piping in LRA Table 2.3.3-14-17, "Potable Water System." Since the waste water is not considered treated water, a line item is added to LRA Table 3.3.2-14-17, "Potable Water System [10 CFR 54.4(a)(2)]," along with a conforming change to LRA Section B.1.3 1,…

In its response to RAI 2.3.3.12 PD-4, dated November 30, 2009, the applicant also stated:

> Roof drain piping and piping components passing through the internal portions of the areas listed below that contain SSCs in scope for 10 CFR 54.4(a)(1) are in scope and subject to aging management review based on the criterion of 10 CFR 54.4(a)(2). The components are listed as component types "bolting" and "piping" in LRA Table 2.3.3-14-9, "Floor Drains, Nonradioactive System."
>
> Control Building, Diesel Generator Rooms, Intake Structure service water pump room, OG Building, Reactor Building (excluding the railroad airlock), and Turbine Building (excluding the turbine building basement)

Based on its review, the staff finds the applicant's response to RAI 2.3.3.12 PD-4 acceptable. The applicant will include the piping and piping components of roof drains which are internal to buildings that contain SSC in-scope for license renewal for 10 CFR 54.4(a)(1), to be subject to AMR based on 10 CFR 54.4(a)(2). The components are listed as component types "bolting" and "piping" in LRA Table 2.3.3-14-9, "Floor Drains, Nonradioactive System."

The applicant has identified the pipe in the emergency battery room as waste water and has added a line item to LRA Table 3.3.2-14-17 to include this pipe type as subject to an AMR in accordance with 10 CFR 54.4(a)(2).

<u>Non-Radioactive Floor Drains System</u>. The purpose of the FDN system is to collect and remove non-radioactive liquid from its point of origin to appropriate discharge to the river. The system includes floor drains, sumps, and sump pumps with associated piping and valves. The failure of nonsafety-related SSCs in the FDN system potentially could prevent the satisfactory accomplishment of a safety-related function. LRA Tables 2.3.3-12 and 2.3.3-14-9 identify component types for the FDN system within the scope of license renewal and subject to an AMR.

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

<u>Radwaste System</u>. The purpose of the RW system is to collect, process, store, and dispose of radioactive liquid wastes and to collect, process, package, and provide temporary storage facilities for solid wastes prior to shipment for offsite processing and/or disposal. The liquid radwaste portion of the RW system includes piping and equipment drains carrying potentially radioactive wastes; floor drain systems in areas which may contain potentially radioactive wastes; tanks, piping, pumps, process equipment, instrumentation, and auxiliaries necessary to collect, process, store, and dispose of potentially radioactive wastes; and tanks and sumps used to collect potentially radioactive wastes. The RW system contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related

SSCs in the RW system potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the RW performs functions that support fire protection. LRA Tables 2.3.3-12 and 2.3.3-14-23 identify component types for the RW system within the scope of license renewal and subject to an AMR.

The staff reviewed LRA Section 2.3.3.12, USAR Sections IX-2.0, IX-3.0, and X-14.0, and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff 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 2.3.3.12 PD-1, dated July 16, 2009, the staff noted in the license renewal drawing LRA-2005 SH 2 that the applicant did not show the Z sump within the scope of license renewal. The Z sump contains safety-related components and is essential to keeping the elevated release point (ERP) clear of water. Table 2.4-3, "Turbine Building, Process Facilities, and Yard Structures," lists sumps as a component for the intended function of support for criterion (a)(1), (a)(2), or (a)(3) equipment. However, the applicant does not specifically identify which sump is within the scope of license renewal and subject to an AMR; whereas the applicant specifically identifies the reactor building sump structure and liner, and drywell sumps and liners as being within the scope of license renewal. The staff asked the applicant to identify which sumps are included in Table 2.4.3, particularly the Z sump, and whether or not they are within the scope of license renewal and subject to an AMR.

In its response to RAI 2.3.3.12 PD-1, dated August 17, 2009, the applicant stated that the Z sump is a structural component and is included within the LRA Table 2.4-3 Concrete item "Sump." The Z sump is discussed under "Elevated Release Point Tower," and is within the scope of license renewal and subject to an AMR. The Z sump is not highlighted because it is a structural component and structural components are not highlighted on drawings. Other sumps included in Table 2.4-3 are those sumps associated with the turbine building and appendages, DG building, ARB, OG and fan building, and the radwaste building discussed in LRA Section 2.4.3, "Turbine Building, Process Facilities and Yard Structures."

The staff finds the response to RAI 2.3.3.12 PD-1 acceptable because the applicant stated that the Z sump is within the scope of license renewal and subject to an AMR, and identified which sumps are included in Table 2.4.3.

In RAI 2.3.3.12 PD-2, dated July 16, 2009, the staff noted on license renewal drawing LRA-2005 SH 2 that the applicant shows several piping runs coming out of the turbine building radioactive area sumps, passing through the "turbine building" then transitioning into the yard or into the radwaste building. The applicant has specified fluid-filled components in the "turbine building" as within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2), however, the applicant does not highlight the sump pumps and discharge piping on this license renewal drawing. The staff asked the applicant to justify the exclusion of the above mentioned piping and pumps and other components in this area that may have been omitted from the scope of license renewal.

In its response to RAI 2.3.3.12 PD-2, dated August 17, 2009, the applicant stated that fluid-filled components in the turbine building (excluding the basement) are within the scope of license renewal and subject to an AMR, in accordance with 10 CFR 54.4(a)(2). However, the turbine building radioactive area sumps and associated components (e.g., pumps, piping, and valve bodies) shown on license renewal drawing LRA-2005-SH02 are assigned to the RW or FDN and located in the turbine building basement which contains no safety-related components. Failure of these and other components in this area cannot prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a)(1). Therefore, these components are not within the scope of license renewal and are not subject to an AMR, in accordance with 10 CFR 54.4(a)(2).

The staff finds the response to RAI 2.3.3.12 PD-2 acceptable because the applicant clarified that the fluid filled components of concern are located in the turbine building basement and cannot prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a)(1). Therefore, these components are not within the scope of license renewal and are not subject to an AMR, in accordance with 10 CFR 54.4(a)(2).

In RAI 2.3.3.12 PD-3, dated July 16, 2009, the staff noted on license renewal drawing LRA-2005 SH 2 that the applicant shows the discharge piping coming out of the two ERP Z sump pumps, transitioning to one pipe (3-inch FDR-1), which continues onto license renewal drawing LRA-2038 SH 1 (J-1), where the piping passing through the reactor building then transitions into the radwaste building on license renewal drawing LRA-2032 SH 2 (D-1). One branch continues into the “floor drain collection tank,” and the other piping continues onto license renewal drawing LRA-2033, sheet 2 (C-5), where the piping ends in the “waste collector tank.” The applicant has identified SCs supporting the operation of the Z sump pumps within the scope of license renewal and in accordance with 10 CFR 54.4(a)(1). As pointed out above, some of the piping run into the radwaste building. Based on the applicant’s methodology for scoping nonsafety-related system components, SCs in the radwaste building should be considered within the scope of license renewal in accordance with 10 CFR 54.4(a)(2) since these components are located in a space containing safety-related SSCs. Therefore, the staff requested the applicant to justify the exclusion of SCs in the radwaste building from the scope of license renewal, in accordance with 10 CFR 54.4(a)(2), and subject to an AMR.

In its response to RAI 2.3.3.12 PD-3, dated August 17, 2009, the applicant stated that the safety function of the RW system components is to support Z sump function (i.e., remove excess water from the Z sump to assure SGT system operation). The applicant further stated that the only safety-related components that perform this function are the sump pumps (1-Z-1, 1-Z-2), discharge check valves (RW-CV-58CV, RW-CV-59CV), and associated piping located outside the Z sump. The applicant stated that valves RW-V-I0 and RW-V-11 and the remaining portion of the flow path to the radwaste building are nonsafety-related. The applicant stated that the RW system intended function to provide a barrier to ground level release via the Z sump during accidents where the SGT system must operate, is an intended function in accordance with 10 CFR 54.4(a)(2) criterion per the response to RAI 2.3.3.12.OG-6. The applicant then concluded that since valves RW-V-I0 and RW-V-11 and the remaining portion of the flow path to the radwaste building are nonsafety-related and do not perform a function in accordance with 10 CFR 54.4(a)(1), fluid-filled components in this location, specifically the radwaste building, are not within the scope of license renewal and are not subject to an AMR, in accordance with 10 CFR 54.4(a)(2).

The staff did not find the response to RAI 2.3.3.12 PD-3 acceptable because the applicant attributed valves RW-V-I0 and RW-V-11 and the remaining portion of the flow path to the radwaste building as nonsafety-related with an intended function in accordance with 10 CFR 54.4(a)(2). This is inconsistent with USAR Chapter X, Section 14.2, which lists the safety design basis (intended function) of the equipment and floor drainage systems. This section lists two safety design bases. The first safety design basis is to ensure that the Z sump in-flow from condensation does not impede the flow of the SGT system to the ERP. The second safety design basis is to provide a barrier to ground level release via the Z sump during accidents where the SGT system must operate. Since valves RW-V-I0 and RW-V-11 and a portion of the downstream pipe do function to prevent a ground release, the staff did not agree that this section of piping should be classified nonsafety-related (relative to scoping and screening of the SSC in accordance with 10 CFR 54) and classified as serving a 10 CFR 54.4(a)(2) function. Therefore, the staff issued RAI 2.3.3.12 PD-5, to state that the applicant needs to resolve this apparent inconsistency with USAR Chapter X, Section 14.2, where it designated the RW system function of providing “a barrier to ground level release via the Z sump during accidents where the SGT system must operate” as an intended function in accordance with 10 CFR 54.4(a)(2). The applicant also needs to justify why it designated valves RW-V-I0 and RW-V-11 and the remaining portion of the flow path as nonsafety-related, since this section of piping is integral to accomplishing the safety design function of USAR Chapter X, Section 14.2.

In its response to RAI 2.3.3.12 PD-5, dated November 30, 2009, the applicant stated that a safety design basis as defined in CNS USAR Section I-2.0 is not necessarily a safety function in accordance with 10 CFR 54.4(a)(1), and in this case the piping downstream of the check valves does not meet the criteria of 10 CFR 54.4(a)(1). In subsequent interactions, the staff also stated that the applicant needs to evaluate the loss of the barrier to ground level release by considering the piping between the Z sump and any of the nine loop seals. In a teleconference on January 14, 2010, the applicant stated that the loop seals are not safety-related and their function is not credited to mitigate the consequences of accidents which could result in potential offsite exposure comparable to those referred to in 10 CFR 100, as applicable. By letter dated March 25, 2010, the applicant supplemented its response to RAI 2.3.3.12 PD-5 to confirm this statement, therefore, resolving the staff’s concern.

Air Removal. The purpose of the AR system is to remove non-condensable gases from the condenser. The system includes two steam jet air ejector units complete with inter-and after-condensers to remove air and non-condensable gases from the main condenser. Mechanical vacuum pumps are provided for startup and shutdown. The AR system contains safety-related components relied upon to remain functional during and following DBEs. LRA Table 2.3.3-12 identifies component types for the AR system within the scope of license renewal and subject to an AMR.

The staff reviewed LRA Section 2.3.3.12, USAR Section XI-4.0, and a license renewal drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

During its review of LRA Section 2.3.4.2, the staff 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 RAI is discussed below.

In RAI 2.3.3.12 AR-1, dated July 16, 2009, the staff noted in the LRA the applicant indicated that the AR system contained two safety-related valves that supported the Z sump function. The staff could not positively locate these valves nor identify their (a)(1) function. The staff requested the applicant provide their locations on the system drawings and provide their function.

In its response to RAI 2.3.3.12 AR-1, dated August 17, 2009, the applicant identified the two safety-related valves as AF-V-113 and AF-V-114. The applicant stated that these valves are part of the path that monitors the differential pressure that could occur between the OG holdup line and the Z sump. No other specific function was identified other than as part of the safety-related flow path.

In addition, the applicant performed a review of the AR system function to support Z sump and amended the LRA description of the AR system and its (a)(1) functions. The applicant deleted the function for AR system to “provide a barrier to ground release via the Z sump during accidents where the SGT system must operate.” In its response to RAI 2.3.3.12 OG-6, the applicant confirmed that the RW system is the only system that supports this function.

The staff finds the response to RAI 2.3.3.12 AR-1 acceptable because the applicant identified the safety-related components the staff questioned in the AR system, and the components were included within the scope of license renewal and subject to an AMR. The staff’s review of the deleted (a)(1) function is performed separately under the RW system. Therefore, the staff’s concern described in RAI 2.3.3.12 AR-1 is resolved.

In RAI 2.3.3.12 AR-2, dated July 16, 2009, the staff identified a safety function in the applicant’s USAR, Chapter 14, for the AR system that was not dispositioned in the LRA. The USAR states that the MS line high radiation signal immediately trips the mechanical vacuum pumps and closes the pumps’ inlet and outlet valves in the event of a dropped rod accident. The LRA does not identify this function under the AR system nor do the drawings supporting the LRA highlight the flow path. The staff asked the applicant to explain the valves’ exclusion from the scope of license renewal.

In its response dated August 17, 2009, the applicant stated that the isolation valves for the mechanical vacuum pumps have an intended function of isolating the vacuum pumps from the main condenser in the event of a dropped rod accident. The applicant indicated that these isolation valves were classified as nonsafety-related. Therefore, for the AR system, the applicant added to the LRA an intended function for 10 CFR 54.4 (a)(2), “Isolate the mechanical vacuum pumps on a high radiation signal.” The applicant evaluated the valves for inclusion within the scope of license renewal and provided an explanation for their exclusion. The applicant’s reason was that the valves perform their isolation function with moving parts, and the passive pressure boundary provided by the valve bodies is not required to prevent the vacuum pumps from actively discharging air from the condenser through the ERP. Therefore, the applicant’s position is that the valves are not subject to an AMR.

The staff did not find this response acceptable. The staff does not agree with the rationale provided to exclude the isolation valves from the scope of license renewal and subject to an AMR. In accordance with 10 CFR 54.21, valve bodies are long-lived passive components that are subject to an AMR. In addition, the piping from the condenser to the valves and the associated components are also in-scope as passive, long-lived components that should be within the scope of license renewal and subject to an AMR. These components are essential for the safety function to be fulfilled. A similar issue was identified with the steam jet air ejectors on RAI 2.3.3.12-AR-3. In addition, the piping downstream of the isolation valves, 12-inch AR-2, leads to holdup line, 16-inch AR-2, which is within the scope of license renewal. If the pressure boundary of 12-inch AR-2 is lost, the intended function for 16-inch AR-2 is also lost. Thus, 12-inch AR-2 in the turbine building should also be included within the scope of license renewal. Therefore, the staff submitted RAI 2.3.3.12-AR-4, dated October 29, 2009, stating that the applicant needs to include the passive, long-lived components that are necessary to isolate the flow path up to and including the isolation valves for the mechanical vacuum pumps and are within the scope of license renewal in accordance with 10 CFR 54.21, or provide an adequate justification that is in accordance with 10 CFR 54.21. The staff also stated that the applicant needs to include the long-lived components from the isolation valves in piping 12-inch AR-2 up to and including the 16-inch AR-2 holdup line within the scope of license renewal in accordance with 10 CFR 54.4(a) or provide an adequate justification why a failure of this piping will not cause a loss of the pressure boundary function on 16-inch AR-2.

In its response to RAI 2.3.3.12 AR-4 (Part A&B), dated November 30, 2009, the applicant stated that the piping and components from the main condenser up to and including the mechanical vacuum pumps' inlet isolation valves should be included in the scope of license renewal and subject to an AMR.

In addition, components upstream of the 16-inch AR-2 holdup line back to the mechanical vacuum pumps' outlet isolation valves, and back to the gland exhauster fans inside the turbine building will also be included in the scope of license renewal and subject to an AMR. These component type AMRs are covered by existing line items in LRA Table 3.3.2-12.

The staff's review of the applicant's response to RAI 2.3.3.12 AR-4 (Part A&B), in respect to the mechanical vacuum pumps, determined that the response was acceptable because it included components in the scope of license renewal that perform the isolation function of the condenser to the mechanical vacuum air ejectors and included components in scope that are attached to the holdup line and have the potential for causing a ground level release. Therefore, the staff's concern described in RAI 2.3.3.12 AR-4 (Part A&B) is resolved.

In RAI 2.3.3.12 AR-3, dated July 16, 2009, the staff identified a safety function in the applicant's USAR Chapter 14, for the AR system that was not dispositioned in the LRA. The USAR states that in the event of a dropped rod accident, a high radiation signal from the air ejector process radiation monitors automatically closes the outlet isolation valve on the steam jet air ejectors. The LRA does not identify this function under the AR system nor do the license renewal drawings highlight the flow path and valve. The staff asked the applicant to justify the valves' exclusion from the scope of license renewal.

In its response to RAI 2.3.3.12 AR-3, dated August 17, 2009, the applicant stated that the isolation valve for the steam jet air ejectors have an intended function of isolating the main condenser in the event of a dropped rod accident. The applicant stated that the piping up to and including the isolation valve, OG-AO-254, located in the OG building, were required to maintain their pressure boundary to support the isolation function. Since the piping and the isolation valve were classified as nonsafety-related, the applicant included them within the scope of license renewal in accordance with 10 CFR 54.4(a)(2) and evaluated in the plant drains AMR.

The staff determined this response unacceptable because the applicant did not assess the piping in this flow path that is inside the turbine building as part of the flow path that is required to be within the scope of license renewal. In response to RAI 2.3.3.12 AR-3, the applicant added a new (a)(2) function to isolate the air ejectors on a high radiation signal, and added components in the flow path that is from the turbine building to the isolation valve in the OG building. However, components in the flow path in the turbine building are also needed to perform this function. Therefore, the staff submitted RAI 2.3.3.12 AR-4, dated October 29, 2009, asking the applicant to include the passive piping and components upstream of piping 48-inch AR-1 to the condenser within the scope of license renewal in accordance with 10 CFR 54.4(a), or provide an adequate justification for not including the piping in the flow path inside the turbine building.

In its response to RAI 2.3.3.12 AR-4 (Part C), dated November 30, 2009, the applicant stated that the piping and components upstream of 48-inch AR-1 to the main condenser, which supply the steam jet air ejectors (SJAE), should be included in the scope of license renewal and subject to an AMR. In addition, SJAE components outside the turbine building up to the OG building were included in the scope of license renewal in response to RAI 2.3.3.12 AR-3.

Upon further review of the AR and OG systems, in order to support the function to prevent a ground level release, the applicant added in the scope of license review: piping 1-OG-101-14, from the ERP back to OG isolation valve, OG-AO-254, piping inside the turbine building from 14-inch AR-2 holdup line back to the isolation valve OG-AO-254; piping up to the outlet check valves on the OG dilution fans; and sample pump flow path to the Kaman radiation monitors.

The staff's review of the applicant's response to RAI 2.3.3.12 AR-4 (Part C) in respect to the SJAE, determined that the response was acceptable because it included components in the scope of license renewal that perform the isolation function of the condenser to the SJAEs. Therefore, the staff's concern described in RAI 2.3.3.12 AR-4 (Part C) is resolved.

The staff reviewed the LRA, UFSAR, RAI responses, and LRA drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff found no omission of components that should be included within the scope of license renewal.

Therefore, on the basis of its review, the staff concludes that the applicant has appropriately identified the AR system components within the scope of license renewal in accordance with 10 CFR 54.4(a), and those subject to an AMR in accordance with 10 CFR 54.21(a)(1).

Off-Gas System. The purpose of the OG system is to collect and process gaseous radioactive effluents to minimize their release to the atmosphere. The OG system receives gaseous radwaste from the main condenser steam jet air ejectors, the mechanical vacuum pumps, the gland steam condensers, and other minor sources. The OG system includes the air ejector OG subsystem and the gland seal OG subsystem. The OG system contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the OG system potentially could prevent the satisfactory accomplishment of a safety-related function. LRA Tables 2.3.3-12 and 2.3.3-14-14 identify component types for the OG system within the scope of license renewal and subject to an AMR.

The staff reviewed LRA Section 2.3.3.12, USAR Section IX-4.3, and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff 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 2.3.3.12 OG-1, dated July 16, 2009, the staff noted on the license renewal drawing showing the components inside the Z sump that the applicant did not include several OG and SGT piping and valves. Since some of the other piping and valves inside the sump were safety-related, the staff questioned why these OG and SGT components were not included within the scope of license renewal if they were in the same space with the potential to interact with safety-related components.

In its response to RAI 2.3.3.12 OG-1, dated August 17, 2009, the applicant evaluated these OG and SGT components inside the Z sump and determined that since the components are not pressurized and normally contain only air, then they could not adversely affect the safety-related components through spatial interaction. Therefore, the applicant did not include these components within the scope of license renewal.

The staff finds the response to RAI 2.3.3.12 OG-1 acceptable because the applicant's evaluation of the nonsafety-related components in the Z sump determined that they could not interact spatially with the safety-related components. Therefore, the staff's concern described in RAI 2.3.3.12 OG-1 is resolved.

In RAI 2.3.3.12 OG-2, dated July 16, 2009, the staff noted on license renewal drawing LRA-2009 that the applicant highlighted the OG sample drain tank and associated components in yellow indicating that they are within the scope of license renewal. However, the staff noted that there are other fluid-filled components on this drawing that were not highlighted, and no room transition was indicated on the drawing into another plant area. The staff requested the applicant justify the exclusion of the other fluid-filled components on this license renewal drawing from the scope of license renewal.

In its response to RAI 2.3.3.12 OG-2, dated August 17, 2009, the applicant stated that the piping connected to the drain tank is not fluid-filled and cannot spatially impact safety-related components. Also shown on this license renewal drawing are the steam jet air ejectors, which are high energy components assigned to the MS system. They are located in a different area than the drain tank (i.e., the turbine building basement). However, the steam jet air ejectors were re-evaluated and re-classified as within the scope of license renewal, as explained in the response to RAI 2.1-1.

On the basis of its review, the staff finds the response to RAI 2.3.3.12 OG-2 acceptable because the applicant identified those fluid-filled components within the scope of license renewal and excluded those components that contained only air or gas from spatial interaction. Refer to RAI 2.1-1 for additional nonsafety-related components in the turbine building that were included within the scope of license renewal due to potential interaction with safety-related components. Therefore, the staff's concern described in RAI 2.3.3.12 OG-2 is resolved.

In RAI 2.3.3.12 OG-3, dated July 16, 2009, the staff noted one of the functions of the OG system was to ensure that the drainage to the Z sump did not exceed the capacity of one sump pump. In LRA Table 2.3.3.12, the applicant listed a restriction orifice. The staff could not locate the restriction orifice on the license renewal drawings and requested the applicant provide the location on the system drawings of this flow restrictor.

In its response to RAI 2.3.3.12 OG-3, dated August 17, 2009, the applicant stated that the component type, "restriction orifice," identified on LRA Table 2.3.3.12(PD) are shown on license renewal drawing LRA-2037 (B-9). But the flow restrictor credited in the OG system for ensuring a limited flow to the sump was a 2-inch to 1¼-inch reducer inside the Z sump on license renewal drawing LRA-2005, sheet 2. The flow restrictor (pipe reducer) is included within the scope of license renewal and subject to an AMR as component type "piping" with an intended function of pressure boundary and flow control in LRA Table 2.3.3-12 (PD).

On the basis of its review, the staff finds the response to RAI 2.3.3.12 OG-3 acceptable because the applicant identified the restriction orifice and the flow restrictor as fluid-filled components within the scope of license renewal and subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.12 OG-3 is resolved.

In RAI 2.3.3.12 OG-4, dated July 16, 2009, the staff noted on the license renewal drawing 2037, the applicant highlighted, in orange, a ¾-inch line off the 12-inch AR-1 holdup line to a differential pressure transmitter OG-DPT-550 and switch OG-DPIS-550. The LRA states that the AR system has no functions for either (a)(2) or (a)(3), implying that line was within the scope of license renewal in accordance with 10 CFR 54.4(a)(1). However, the applicant did not highlight the other side of the pressure instruments that were directly connected to this (a)(1) piping in accordance with10 CFR 54.4(a)(2). The staff requested the applicant to justify the exclusion of piping directly connected to the safety-related piping and pressure instruments.

In its response to RAI 2.3.3.12 OG-4, dated August 17, 2009, the applicant stated that the orange ¾-inch line off the 12-inch AR-1 holdup line to pressure instruments OG-DPT-550 and OG-DPIS-550 was within the scope of license renewal, in accordance with10 CFR 54.4(a)(2); that the instruments and the associated piping were nonsafety-related; and only highlighted on one side because they do not perform a safety function for pressure measuring, but perform a function of pressure boundary for the safety-related differential pressure instruments OG-DPIS-114 and OG-DPT-114, shown on LRA Drawing 2037 (C-10). The applicant further explained that the 12-inch AR-1 piping should also have been included within the scope of license renewal, and is subject to an AMR as component type "piping" in LRA Table 2.3.3-12(PD).

On the basis of its review, the staff finds the response to RAI 2.3.3.12 OG-4 acceptable because the applicant identified the piping to OG-DPT-550 and OG-DPIS-550 were within the scope of license renewal under a functional (a)(2) for pressure boundary; hence the opposite side of the instruments were required to be included within the scope of license renewal as nonsafety-related attached to safety-related components, and they were not required to support the pressure boundary function. The applicant did expand the scoping of components to include the 12-inch AR-1 piping. Therefore, the staff's concern described in RAI 2.3.3.12 OG-4 is resolved.

In RAI 2.3.3.12 OG-5, dated July 16, 2009, the staff noted in LRA Section 2.3.3.12 for the OG system that the applicant included several piping runs with instrumentation in the OG building within the scope of license renewal and highlighted orange on license renewal drawing LRA-2037, indicating the piping is within the scope of license renewal in accordance with 10 CFR 54.4(a)(1). However, the applicant did not highlight the attached piping/duct to this (a)(1) piping, in accordance with10 CFR 54.4(a)(2). In addition, since these (a)(1) components are in the OG building, then the other fluid filled components in the room should be within the scope of license renewal. Yet the oil system that supports the OG system is not shown as within the scope of license renewal. The staff requested that the applicant justifies the exclusions of the attached piping components and the oil system components from the scope of license renewal.

In its response to RAI 2.3.3.12 OG-5, dated August 17, 2009, the applicant stated that it has revised the LRA Section 2.3.3.12 (PD) to be consistent with its response to RAI 2.3.3.12 OG-6. The applicant is removing the (a)(1) function from the OG system to provide a barrier to ground level release. Only the RW system will be credited with this function. The applicant explained in its response to RAI 2.3.3.12 OG-4 that the orange highlighted piping to OG-DPT-550 and

OG-DPIS-550 was within the scope of license renewal for a functional (a)(2) not (a)(1) as a pressure boundary for the safety-related instruments OG-DPT-114 and OG-DPIS-114. Therefore, the applicant's position is that there are no safety-related components in the OG building; hence, the oil system components are not required to be included within the scope of license renewal. In lieu of the deleted function, the applicant added the (a)(1) function to maintain secondary containment integrity for the OG system, which includes components that vent the Z sump to the ERP that are safety-related and support secondary containment during post-accident conditions.

On the basis of its review, the staff found the applicant's response to RAI 2.3.3.12 OG-5 unacceptable. The applicant provided a review of the safety-related components in the OG that was performed under RAI 2.3.3.12 OG-7. The applicant's list showed no safety-related components in the OG building. However, the staff noted that part of the piping to pressure instruments OG-DPT-550 and OG-DPIS-550 included piping to monitor and equalize the vacuum between the OG 48-inch holdup line and the Z sump. This function is described in USAR Chapter IX, Section 4.5.1 as having the capability to interfere with post-accident Z sump operation. The applicant identified these monitoring instruments as safety-related, but did not identify their location, which appears to be in the OG building. Since the monitoring is safety-related, the equalization line should also be safety-related. From license renewal drawing LRA-2037, the ¾-inch equalization line appears to be in the OG building as well. Having these safety-related components in the OG building contradicts the applicant's information provided in the RAI response that there are no safety-related components in the OG building. Therefore, the staff submitted RAI 2.3.3.12 OG-9, dated October 29, 2009, stating that the applicant needs to examine whether or not there are safety-related components in the OG building, to include the instruments used to monitor the pressure in the sump and the equalization line from the Z sump to the holdup line, for inclusion within the scope of license renewal in accordance with 10 CFR 54.4(a)(1); and perform an evaluation of nonsafety-related components for inclusion within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). Additionally, the applicant needs to amend the LRA to add the (a)(1) functions for monitoring and equalizing the sump with the holdup line, also identified in RAI 2.3.3.12 OG-7.

In its response to RAI 2.3.3.12 OG-9, dated November 30, 2009, the applicant stated that the OG building does in fact contain safety-related components that support the OG system intended function for monitoring and equalization of the Z sump with the 48-inch holdup line. The applicant has included these components in-scope under the 10 CFR 54.4 (a)(1) function for the OG system, supporting the Z sump function, which encompasses the monitoring and equalization function. The applicant's evaluation of nonsafety-related components in the OG building for potential interaction with these safety-related components required the applicant to add the low pressure fluid-filled components in the OG sample pump oil subsystem into the scope of license renewal under 10 CFR 54.4(a)(2) and subject to an AMR.

The staff's review of the applicant's response to RAI 2.3.3.12 OG-9 found the response acceptable because the applicant properly identified safety-related components in the OG building and included those nonsafety-related components into scope with the potential for interaction. Therefore, the staff's concern described in RAI 2.3.3.12 OG-9 is resolved.

In RAI 2.3.3.12 OG-6, dated July 16, 2009, the staff noted that the LRA describes one of the functions of the OG system is to prevent a ground level release. The USAR describes two subsystems of the OG system, air ejector system, and gland seal system. Both of these systems serve as holdup lines for gases from the main condenser. The staff could not find in the LRA a description of these subsystems and their intended functions. The staff requested that the applicant explain what role these subsystems have in the intended function to prevent a ground release.

In its response to RAI 2.3.3.12 OG-6, dated August 17, 2009, the applicant evaluated the systems required to perform the intended function to prevent a ground level release, and determined that the only system that performs this function was the RW system. The intended functions, in accordance with 10 CFR 54.4(a)(1), for the OG were revised to include 1) venting the Z sump to the ERP and 2) monitoring and equalizing the vacuum between the 48-inch holdup line and the Z sump.

On the basis of its review, the staff finds the applicant's response to RAI 2.3.3.12 OG-6 acceptable. The applicant revised the intended functions for the OG system to remove the 54.4(a)(1) function to prevent a ground level release, and clarified that only the RW supports this function and not the air ejector or gland seal systems. In addition, the applicant added specific functions for the OG system to include venting and monitoring the Z sump. Therefore, the staff's concern described in RAI 2.3.3.12 OG-6 is resolved.

In RAI 2.3.3.12 OG-7, dated July 16, 2009, the staff noted in the LRA Section 2.3.3.12 there were functions identified for the OG system in accordance with 10 CFR 54.4(a)(1), indicating that the OG system contained safety-related components. The staff requested the applicant identify the safety-related components in the OG system and the safety function they provide.

In its response to RAI 2.3.3.12 OG-7, dated August 17, 2009, the applicant identified the safety function that the OG system performs is venting the Z sump to the ERP, and monitoring and equalizing the vacuum between the 48-inch holdup line and the Z sump. The applicant provided a list of the identification numbers of the safety-related valves and their location on license renewal drawings LRA-2037 and LRA-2005, sheet 2.

On the basis of its review, the staff found the applicant's response to RAI 2.3.3.12 OG-7 unacceptable. The applicant supplied a list of the safety-related valves in the OG system from its database. However, the applicant did not provide any piping line numbers. There are several runs of piping that do not have valves; therefore, the staff cannot positively identify the lines that are safety-related. In addition, the staff questions whether or not the list provided is complete. There are other valves that appear to be on safety-related lines. On license renewal drawing LRA-2005, sheet 2 there are two drain lines from the ERP to the Z sump. The list provided by the applicant includes OG-113, hence indicating that line 1½-inch FDR-2 is safety-related; however, the redundant line 1½-inch FDR-2 that is heat-traced contains valve OG-104, which was not included on the list of safety-related valves in the OG system. Therefore, the staff issued RAI 2.3.3.12 OG-10, dated October 29, 2009, stating that the applicant needs to perform an in-depth review of the OG system and provide a complete list of safety-related components, to include piping, in order for the staff to ensure that no components were omitted from the scope of license renewal.

In its response to RAI 2.3.3.12 OG-10, dated November 30, 2009, the applicant stated that the monitoring and equalization function of the OG system was conservatively added within the scope of license renewal under 10 CFR 54.4(a)(1); even though the applicant determined it was not required to function during or following a design basis event. The applicant stated that the function is there to "ensure the readiness of the SGT system." However, any nonsafety-related components in the OG building with possible interactions were included within the scope of license renewal under 10 CFR 54.4(a)(2) conservatively (refer to RAI 2.3.3.12 OG-9). The applicant's review of other vent and drain lines from the ERP to the sump did not identify any other nonsafety-related components that needed to be included in-scope that were not already in-scope.

The staff's review of the applicant's response to RAI 2.3.3.12 OG-10 found the response acceptable, because the applicant's review of the components required to perform the intended 10 CFR 54.4(a)(1) function for the OG system were conservatively added within the scope of license renewal and subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.12 OG-10 is resolved.

In RAI 2.3.3.12 OG-8, dated July 16, 2009, the staff noted in LRA Table 2.2-2, the applicant listed the augmented OG system as excluded from the scope of license renewal. However, the USAR describes this system as part of the air ejector and gland seal system, which have an 10 CFR 54.4(a)(1) function to prevent a ground level release. Hence, this system may interact and may be required for inclusion within the scope of license renewal in accordance with 10 CFR 54.4(a)(1). The staff requested that the applicant justify the exclusion of the augmented OG system from the scope of license renewal.

In its response to RAI 2.3.3.12 OG-8, dated August 17, 2009, the applicant explained that the functions for the air ejector and gland seal systems were revised to be within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The applicant revised the (a)(1) function to provide a barrier against a ground level release to be an (a)(2) function, and only for the RW system. Details are provided in the response to RAI 2.3.3.12 OG-6. Therefore, the air ejector and gland seal systems no longer have this (a)(1) function. The augmented OG system is located in the radwaste building or the ARB. The applicant's review of the components in these structures did not reveal any safety-related components. Therefore, the applicant concluded that the augmented OG system does not have any nonsafety-related components that have the potential to affect safety-related components; hence, the system has no (a)(2) components.

On the basis of its review, the staff finds the response to RAI 2.3.3.12 OG-8 acceptable because the applicant revised the function to prevent a ground level release, and evaluated that there are no safety-related components in the structures that contain augmented OG components. Therefore, there is no requirement for these components to be included within the scope of license renewal in accordance with 10 CFR 54.4 (a)(2). Therefore, the staff's concern described in RAI 2.3.3.12 OG-8 is resolved.

The staff reviewed the LRA, USAR, RAI responses, and applicable boundary drawings to determine whether or not the applicant failed to identify any SSCs within the scope of license renewal. The staff found no omission of components that should be included within the scope of license renewal.

On the basis of its review, the staff concludes that the applicant has appropriately identified the OG 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).

2.3.3.12.3 Conclusion

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

2.3.3.13 *Nitrogen Systems*

2.3.3.13.1 Summary of Technical Information in the Application

LRA Section 2.3.3.13 describes the nitrogen (N_2) system. The N_2 system provides a combustible gas control of PC. The system performs initial purging of the PC and provides an automatic supply of makeup N_2.

The N_2 system performs functions that support fire protection. LRA Table 2.3.3-13 identifies the N_2 system components within the scope of license renewal and subject to an AMR.

2.3.3.13.2 Staff Evaluation

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

2.3.3.13.3 Conclusion

Based on the results of the staff evaluation discussed in Section 2.3 and on a review of the LRA, USAR, and applicable system boundary drawings, the staff concludes that the applicant has appropriately identified the N_2 system mechanical components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and that the applicant has appropriately identified the system components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.14 *Auxiliary 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 auxiliary 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: (1) a functional failure where the failure of a nonsafety-related SSC to perform its function impacts a safety function or (2) a physical failure where a safety function is impacted by the loss of structural or mechanical integrity of an SSC in physical proximity to a safety-related component. LRA Section 2.3.3.14 states that functional failures of nonsafety-related SSCs which could impact a safety function are identified in previous LRA sections. These LRA sections are identified in parentheses below. LRA Table 2.3.3.14-A shows systems within the scope of license renewal with the potential for physical interactions with safety-related components. Physical interaction includes physical impact, pipe whip, jet impingement, flooding, or harsh environment.

Portions of the following systems are within the scope of license renewal in accordance with 10 CFR 54.4(a)(2):

- auxiliary condensate drains
- auxiliary steam
- control rod drive (LRA Section 2.3.3.2)
- demineralized water
- diesel generator fuel oil (LRA Section 2.3.3.5)
- diesel generator jacket water (LRA Section 2.3.3.4)
- diesel generator starting air (LRA Section 2.3.3.4)
- fire protection (LRA Sections 2.3.3.6 and 2.3.3.7)
- nonradioactive floor drains (LRA Section 2.3.3.12)
- fuel pool cooling and cleanup (LRA Section 2.3.3.9)
- heating and ventilation (LRA Section 2.3.3.8)
- instrument air (LRA Section 2.3.3.10)
- nuclear boiler instrumentation
- boiler instrumentation
- off-gas (LRA Section 2.3.3.12)
- optimum water chemistry
- post-accident sample
- potable water
- radiation monitoring—process
- radiation monitoring—vent
- radwaste (LRA Section 2.3.3.12)
- reactor equipment cooling (LRA Section 2.3.3.11)
- reactor recirculation
- reactor recirculation lube oil
- reactor water cleanup
- service air (LRA Section 2.3.3.10)
- service water (LRA Section 2.3.3.3)
- standby liquid control (LRA Section 2.3.3.1)
- standby nitrogen injection
- turbine equipment cooling

2.3.3.14.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.14, USAR Sections X-10, X-11.0, VII-8.0, X-19.0, X-15.0, and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.1 and the guidance in SRP-LR Section 2.3. The staff's review of LRA Section 2.3.3.14 identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.3.3.14-1, dated June 29, 2009, the staff requested that the applicant explain the basis for license renewal drawing LRA-2012-SH01 without color coding as within the scope of license renewal, valve ACD-23 and the adjacent section of downstream piping.

In its response dated July 29, 2009, the applicant stated that nonsafety-related valve ACD-23 and adjacent piping are within the scope of license renewal and subject to an AMR, in accordance with10 CFR 54.4(a)(2), and should be shown as color-coded accordingly.

In RAI 2.3.3.14-2, dated June 29, 2009, the staff requested that the applicant clarify the scoping basis in zone B-8 of license renewal drawing LRA-2004-SH02 where a flanged tee and downstream flanged spool piece are color-coded as being within the scope of license renewal, but an adjacent note indicates that the tee and spool piece are normally removed and blank flanges installed.

In its response dated July 29, 2009, the applicant confirmed that the tee and spool pieces are normally removed and that the nonsafety-related blind flanges normally installed are within the scope of license renewal and subject to an AMR, in accordance with10 CFR 54.4(a)(2), and that the blind flanges are evaluated as component type “piping” in LRA Table 3.3.2-14-1, “Auxiliary Condensate Drains System [10 CFR 54.4(a)(2)].”

In RAI 2.3.3.14-3, dated June 29, 2009, the staff requested that the applicant verify the scoping color coding in zone B-4 of license renewal drawing LRA-2042-SH01 where the 6-inch diameter RWCU line from valve MO-18 out to flow element FE-170 and the ¾-inch instrument lines associated with FE-170 are color-coded red as being within the scope of license renewal as part of the RCS boundary. The drawing shows the code boundary break as being at MO-18.

In its response dated July 29, 2009, the applicant stated that although the Class I pressure boundary terminates at valve MO-18, the downstream piping and instrument tubing and valves out to FE-170 are conservatively classified as safety-related and reviewed as part of the RCS. These components are within the scope of license renewal and subject to an AMR, in accordance with10 CFR 54.4(a)(1). The flow element is evaluated in LRA Table 3.1.2-3, “Reactor Coolant Pressure Boundary,” as component type “flow element (non-Class 1),” and the remaining components in question are evaluated in LRA Table 3.1.2-3 as component types “tubing” and “valve body.”

In RAI 2.3.3.14-4, dated June 29, 2009, the staff requested that the applicant verify the scoping color coding on license renewal drawing LRA-2027-SH01 of the piping between test connection valves RR-41 and RR-42, as well as RR-42 itself. These valve and pipe segments are not color-coded as being within the scope of license renewal which appeared inconsistent with the scoping of similar components.

In its response dated July 29, 2009, the applicant stated that valve RR-42 and the piping between RR-41 and RR-42 are within the scope of license renewal and subject to an AMR, in accordance with CFR 54.4(a)(2), and should be color-coded accordingly on the drawing. The valve and piping are evaluated as component types “valve body” and “piping” in LRA Table 3.3.2-14-21, “Reactor Recirculation System [10 CFR 54.4(a)(2)].”

Based on its review, the staff finds the response to RAIs 2.3.3.14-1, 2.3.3.14-2, 2.3.3.14-3, and 2.3.3.14-4 acceptable because the applicant clarified the scoping of the items identified in the RAIs. Therefore, the staff’s concerns described in RAIs 2.3.3.14-1, 2.3.3.14-2, 2.3.3.14-3, and 2.3.3.14-4 are resolved.

<u>Auxiliary Condensate Drains</u>. LRA Section 2.3.3.14 describes the auxiliary condensate drain (ACD) system, which provides the capability to remove condensation from plant air conditioners and heating coils and from steam lines of the AS boiler system. LRA Table 2.3.3-14-1 identifies ACD system component types within the scope of license renewal and subject to an AMR.

The staff reviewed LRA Section 2.3.3.14, USAR Section X-10.1.1, and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff’s review identified areas in which additional information was necessary to complete the review of the applicant’s scoping and screening results. The applicant responded to the staff’s RAIs as discussed below.

In RAI 2.3.3.14-ACD-1, dated July 16, 2009, the staff identified the ACD line (ACD-105-3) within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2), in the service water pump room until it tees into 1-ACD-105-1 ¼-inch piping. The 3-inch piping continues from the service water pump room into the intake structure, but the segment of the 3-inch piping to the intake structure was not highlighted. The staff requested that the applicant justify the exclusion of the 3-inch piping to the intake structure from the scope of license renewal and subject to an AMR.

In its response dated August 17, 2009, the applicant stated that the 3-inch piping to the intake structure "is in-scope and subject to an AMR based on criterion of 10 CFR 54.4(a)(2) and should be highlighted." The applicant also stated that the 3-inch piping is included in LRA Table 2.3.3-14-1 as component type "Piping."

Based on its review, the staff finds the response to RAI 2.3.3.14-ACD-1 acceptable because the applicant clarified that the 3-inch piping should be highlighted from the service water pump room to the intake structure to show that the component is within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.4 (a)(2). Therefore, the staff's concern described in RAI 2.3.3.14-ACD-1 is resolved.

The staff reviewed the LRA, USAR, RAI response, and boundary drawings to determine whether or not the applicant failed to identify any components within the scope of license renewal. In addition, the staff determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes the applicant has appropriately identified the control structure ACD mechanical components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and that the applicant has adequately identified the ACD system mechanical components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

Auxiliary Steam. LRA Section 2.3.3.14 describes the AS system, which transfers steam from the AS boilers to various plant components. Steam is provided for such uses as heating buildings, space humidifiers, air conditioning system reheat coils, performance of minimum power tests on turbines for HPCI and RCIC pumps, and backup supply for the steam jet air ejectors and steam seals for the main turbine and RF pump. LRA Table 2.3.3-14-2 identifies AS system component types within the scope of license renewal and subject to an AMR.

The staff reviewed LRA Sections 2.3.3.14 and 2.3.4.1, USAR Section X-10.1.1, and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff 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 2.3.3.14-AS-1, dated July 16, 2009, the staff identified, on license renewal drawing LRA-2012, sheet 2 (location B-6), that the AS piping (4-inch V123-169) was highlighted for being within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). However, the staff noted that the pressure control valve (PCV-805) was not highlighted for being within the scope of license renewal. The staff requested that the applicant justify the exclusion of PCV-805 and other pressure control valves from being within the scope of license renewal.

In its response dated August 17, 2009, the applicant stated that the pressure control valves were not excluded from license renewal, more specifically PCV-805 in license renewal drawing LRA-2012, sheet 2 (location B-6) was included within the scope of license renewal and subject to an AMR.

Based on its review, the staff finds the response to RAI 2.3.3.14-AS-1 acceptable because the applicant clarified that the passive mechanical valve bodies for PCV-805 and other pressure control valves are within the scope of license renewal and subject to an AMR in accordance with10 CFR 54.4 (a)(2). Therefore, the staff's concern described in RAI 2.3.3.14-AS-1 is resolved.

In RAI 2.3.3.14-AS-2, dated July 16, 2009, the staff identified, on license renewal drawing LRA-2002, sheet 2 (location E-4), that the 3-inch piping run (AS-3) is highlighted as being within the scope of license renewal in accordance with 10 CFR 54.4 (a)(2). The piping run continues onto license renewal drawing LRA-2002, sheet 3 (location F-3), and includes flow element 115 (FE-115), but the continuation piping is no longer shown highlighted. The 3-inch AS-3 piping transitions through a barrier into the "turbine building" and is shown highlighted, indicating the piping as being within the scope of license renewal. The staff requested that the applicant justify the exclusion of the segment of the 3-inch AS-3 piping containing FE-115 from being within the scope of license renewal.

In its response, dated August 17, 2009, the applicant stated that:

> The 3-inch AS-3 piping segment and FE-115 are assigned to the MS system. Since these are high energy components located in the turbine building basement, the components are in-scope and subject to an AMR based on the criterion of 10 CFR 54.4(a)(2). These piping and flow element components are included in LRA Table 2.3.4-2-9 (MS system), as component types "Piping" and "Flow element."

Based on its review, the staff finds the response to RAI 2.3.3.14-AS-2 acceptable because the applicant clarified that the segment of 3-inch AS-3 piping and FE-115 that is located on license renewal drawing LRA-2002, sheet 3 (location F-3) and identified as high energy components in the turbine building basement are within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.4 (a)(2). Therefore, the staff's concern described in RAI 2.3.3.14-AS-2 is resolved.

In RAI 2.3.3.14-AS-3, dated July 16, 2009, the staff identified several component types that were highlighted as being within the scope of license renewal on license renewal drawing LRA-2002, sheet 3 of the AS system that were not included in LRA Table 2.3.3-14-2. The following component types were examples of component types missing from the table: "Tank/Vessel," "Restricting Orifice," "Flow Element," "Thermowell," and "Rupture Disk." The staff requested that the applicant justify the exclusion of the component types for inclusion in Table 2.3.3-14-2.

In its response dated August 17, 2009, the applicant stated that component type "Tank/Vessel" is identified on license renewal drawing LRA-2002, sheet 3 as HTR A-I and HTR B-1 representing FW heaters. The FW heaters are included as component types "Heat Exchanger (shell)" in LRA Table 2.3.4-2-8 as part of the main condensate (MC) system. The applicant also clarified that the component types "Restricting Orifice," "Flow Element," "Thermowell," and "Rupture Disk" on license renewal drawing LRA-2002, sheet 3 are assigned to the MS system and included in LRA Table 2.3.4-2-9.

Based on its review, the staff finds the response to RAI 2.3.3.14-AS-3 acceptable because the applicant clarified the specific AMR tables in which the above component types are located. The component types in these tables are within the scope of license renewal and subject to an AMR in accordance with10 CFR 54.4 (a)(2). Therefore, the staff's concern described in RAI 2.3.3.14-AS-3 is resolved.

The staff reviewed the LRA, USAR, RAI responses, and boundary drawings to determine whether or not the applicant failed to identify any components within the scope of license renewal. In addition, the staff's review determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes the applicant has appropriately identified the AS system mechanical components within the scope of license renewal, in accordance with10 CFR 54.4(a), and that the applicant has adequately identified the AS system mechanical components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

Demineralized Water. The staff reviewed LRA Section 2.3.3.14.DW, USAR Section X-11.0, and the license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.3.3.14.DW-1, dated July 16, 2009, the staff noted that on license renewal drawing LRA-2013, Zone C12, line 1-DW-108-1 is shown within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2), and subject to an AMR. The continuation of this line on license renewal drawing LRA-2006 SH3 is not shown within the scope of license renewal. The applicant was requested to provide a basis for not including the continuation of 1-DW-108-1 on drawing LRA-2006 SH3 within the scope of license renewal and subject to an AMR.

In its response dated August 16, 2009, the applicant stated that piping and components shown on license renewal drawing LRA-2006-SH03 are located in the turbine building basement, which is an area that contains no safety-related components, thus the subject line is not required to be within the scope of license renewal.

Based on its review, the staff finds the response to RAI 2.3.3.14.DW-1 acceptable because the applicant explained that the piping and components in question were located in an area that contains no safety-related equipment, thus the subject line is not required to be within the scope of license renewal.

In RAI 2.3.3.14.DW-2, dated July 16, 2009, the staff noted that license renewal drawing LRA-2029, Zone D-4, shows the line upstream of valve ¾-inch V-3265-1 coming from license renewal drawing LRA-20100-SH03, Zone D-1 as within the scope of license renewal and subject to an AMR. However, the continuation on license renewal drawing LRA-2010-SH03 is not identified as within the scope of license renewal and subject to an AMR. The applicant was requested to provide a basis for not including the subject line on license renewal drawing LRA-2010-SH03 within the scope of license renewal and subject to an AMR.

In its response dated August 16, 2009, the applicant explained that the license renewal boundary is at the system separation upstream of valve 12-CV, which is the break between the demineralized water system and the service air. The components upstream of valve 12-CV contain gas or dry air and are not required for structural support of any safety-related equipment, thus not required to be included within the scope of license renewal.

Based on its review, the staff finds the response to RAI 2.3.3.14.DW-2 acceptable because the applicant clarified where the license renewal boundary ended.

In RAI 2.3.3.14.DW-3, the staff noted that several license renewal drawings are referenced in the demineralized water system section of the LRA, in which the staff was unable to find any components associated with the demineralized water system. The applicant was requested to explain why these license renewal drawings do not identify any demineralized water system components.

In its response dated August 16, 2009, the applicant explained that the demineralized water system components located on the identified license renewal drawings are not within the scope of license renewal. License renewal drawing LRA-2005-SH01 does not contain any demineralized water system components and reference to this drawing has been deleted from LRA Table 2.3.3.14-C.

Based on its review, the staff finds the response to RAI 2.3.3.14.DW-2 acceptable because the applicant explained why the referenced license renewal drawings did not identify any demineralized water system components within the scope of license renewal. The staff also reviewed the revised LRA Table 2.3.3.14-C and confirmed the deletion of the reference to license renewal drawing LRA-2005-SH01.

The staff reviewed the LRA, USAR, RAI responses (including revised LRA Table 2.3.3.14-C), and license renewal drawings to determine whether or not the applicant failed to identify any components within the scope of license renewal. In addition, the staff's review determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes the applicant has appropriately identified the demineralized water system mechanical components within the scope of license renewal, in accordance with10 CFR 54.4(a), and that the applicant has adequately identified the demineralized water system mechanical components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

Post-Accident Sample System. LRA Section 2.3.3.14 describes the post-accident sample (PAS) system. The purpose of the PAS system is to provide a way to obtain process samples under post-accident conditions. The failure of nonsafety-related SSCs in the PAS system potentially could prevent the satisfactory accomplishment of a safety-related function. LRA Table 2.3.3-14-16 identifies the PAS system component types within the scope of license renewal and subject to an AMR.

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

Potable Water. The staff reviewed the LRA, USAR, and license renewal drawings to determine whether or not the applicant failed to identify any components within the scope of license renewal. In addition, the staff's review determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes the applicant has appropriately identified the potable water (PW) system mechanical components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and that the applicant has adequately identified the PW system mechanical components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

Reactor Water Cleanup. The staff reviewed LRA Section 2.3.3.14.L, USAR Section IV-9.0, and the license renewal drawings using the evaluation methodology described in SER Section 2.3

and the guidance in SRP-LR Section 2.3. The staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.3.3.14.RWCU-1, dated July 16, 2009, the staff noted that license renewal drawing LRA-2027-SH01, Zone A-1, shows conductivity cells within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The conductivity cell is not listed in LRA Table 2.3.3-14-24, "Reactor Water Cleanup System Nonsafety-Related Components Affecting Safety-Related Systems Components Subject to Aging Management Review." The applicant was requested to provide a basis for not listing the conductivity cells in LRA Table 2.3.3-14-24 as a component subject to an AMR.

In its response dated August 16, 2009, the applicant stated that the conductivity cell is included in LRA Table 2.3.3-14-24 as "Piping."

Based on its review, the staff finds the response to RAI 2.3.3.14.RWCU-1 acceptable because the applicant clarified that the conductivity cell is within the scope of license renewal in accordance with the requirements of 10 CFR 54.4(a)(2) and is classified as "Piping."

The staff reviewed the LRA, USAR, RAI response, and license renewal drawings to determine whether or not the applicant failed to identify any components within the scope of license renewal. In addition, the staff's review determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes the applicant has appropriately identified the RWCU system mechanical components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and that the applicant has acceptably identified the RWCU system mechanical components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

<u>Standby Nitrogen Injection</u>. LRA Section 2.3.3.14 describes the standby nitrogen injection (SBNI) system. The purpose of the SBNI system is to provide a source of N_2 for containment inerting following a LOCA in conjunction with a beyond DBE (i.e., ECCS degradation); therefore, the SBNI system is nonsafety-related.

The failure of nonsafety-related SSCs in the SBNI system potentially could prevent the satisfactory accomplishment of a safety-related function. LRA Table 2.3.3-14-28 identifies the SBNI system component types within the scope of license renewal and subject to an AMR.

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

<u>Turbine Equipment Cooling</u>. The staff reviewed LRA Section 2.3.3.14.TEC, USAR Section X-7.0, and the license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.3.3.14.TEC-1, dated July 16, 2009, the staff noted that license renewal drawing LRA-2007-0 identifies several components that have lines shown as within the scope for license renewal and subject to an AMR, in accordance with 10 CFR 54.21(a)(1), with attached components not included within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2). The applicant was requested to provide a basis for not including the attached components.

In its response dated August 16, 2009, the applicant stated that the turbine equipment cooling (TEC) system components are within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2), and subject to an AMR. The cooler shells, filled with gas or air, are not within the scope of license renewal because there is no potential for spatial interactions. The end bells of the coolers are within the scope of license renewal, in accordance with10 CFR 54.4(a)(2) and subject to an AMR. The applicant provided revised LRA Tables 2.3.3-14-29 and 3.3.2-14-29 to include the end bells.

Based on its review, the staff finds the response to RAI 2.3.3.14.TEC-1 acceptable because the applicant adequately clarified what components are within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The staff reviewed revised LRA Tables 2.3.3-14-29 and 3.3.2-14-29 and confirmed the addition of the end bells.

In RAI 2.3.3.14.TEC-2, dated July 16, 2009, the staff noted that license renewal drawing LRA-2007-1 contained several components that are identified as within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2), but are not included in LRA Table 2.3.3-14-29. The applicant was requested to provide a basis for not including the noted components.

In its response dated August 16, 2009, the applicant explained that the heat exchanger shell and bonnets are within the scope of license renewal in accordance with 10 CFR 54.4(a)(2) and subject to an AMR. The shell and bonnets are included in LRA Table 2.3.4-2-6 as “Heat exchanger (shell).” The electro-hydraulic (EH) governor coolers are part of the turbine generator EH fluid system. The coolers are included as component type “Heat exchanger (shell)” and included in LRA Table 2.3.4-2-13. The applicant provided revised LRA Tables 2.3.3-14-29 and 3.3.2-14-29, as described above in the response to RAI 2.3.3.14.TEC-1.

Based on its review, the staff finds the response to RAI 2.3.3.14.TEC-2 acceptable because the applicant adequately clarified what components are within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The staff reviewed revised LRA Tables 2.3.3-14-29 and 3.3.2-14-29.

In RAI 2.3.3.14.TEC-3, dated July 16, 2009, the staff noted that license renewal drawing LRA-2007-0, Zones B-8/C-7, identifies some lines that are identified as within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). However, the continuation of these lines on license renewal drawing LRA-2020, Zone H-6, is not identified as within the scope of license renewal. The applicant was requested to explain why the continuation of the lines was not included within the scope of license renewal.

In its response dated August 16, 2009, the applicant stated that the continuation of the lines on license renewal drawing LRA-2020 are within the scope of license renewal, in accordance with 10 CFR 50.54(a)(2), and subject to an AMR.

Based on its review, the staff finds the response to RAI 2.3.3.14.TEC-3 acceptable because the applicant stated the subject lines are within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).

The staff reviewed the LRA, USAR, RAI response, license renewal drawings, and revised tables to determine whether or not the applicant failed to identify any components within the scope of license renewal. In addition, the staff determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes the applicant has appropriately identified the TEC system mechanical components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and that the applicant has adequately identified the TEC system mechanical components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.3.14.3 Conclusion

The staff reviewed the LRA, USAR, license renewal boundary drawings, and RAI responses to determine whether or not the applicant failed to properly identify any components within the scope of license renewal and subject to an AMR. Based on this review, the staff concludes the applicant has appropriately identified the auxiliary (miscellaneous) systems mechanical components subject to an AMR in accordance with 10 CFR 54.21(a)(2).

2.3.4 Steam and Power Conversion Systems

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

- Section 2.3.4.1, “MSIV Leakage Pathway”
- Section 2.3.4.2, “Steam and Power Conversion Systems In-Scope for 10 CFR 54.4(a)(2)”

2.3.4.1 *Main Steam Isolation Valve Leakage Pathway*

2.3.4.1.1 Summary of Technical Information in the Application

LRA Section 2.3.4.1 describes the MSIV leakage pathway of having the safety objective to direct post-accident MSIV leakage to the main condenser. The seismic Class IIS MS piping that is not part of the RCPB is credited with directing MSIV leakage from the MSIVs to the main turbine condenser during a LOCA and a control rod drop accident. For the LOCA, this alternate leakage treatment (ALT) pathway allows crediting the dose consequence mitigation assumptions related to leakage holdup and the resulting iodine plateout within the condenser. The MSIV leakage pathway starts at the MSIVs. The pathway includes the MS lines up to the main turbine stop valves and other branch and drain piping such as the turbine bypass valves and piping. These lines drain into the main condenser. The main condenser acts as the holdup volume to collect the MSIV leakage and allow plateout of the radioactive iodine.

The MSIV leakage pathway is composed of components in the AS, MC, and MS systems. The components in the MSIV pathway are normally operating and support the normal power operation objectives of providing the flow path for the steam to the main turbine and other secondary plant components. The main condenser has the power operation objective of providing a heat sink for the exhaust from the main turbine, turbine bypass steam, and other flows.

2.3.4.1.2 Staff Evaluation

Auxiliary Steam. LRA Section 2.3.3.14 describes the AS system, which transfers steam from the AS boilers to various plant components. The AS system is already described and evaluated in Section 2.3.3.14B of this safety evaluation.

Main Condensate. LRA Section 2.3.4.1 describes the MC system, which works with the RF system to provide a dependable, high-quality supply of makeup water to the reactor. The MC system provides a mean of preheating the RF. Three one-third capacity motor-driven condensate pumps take the condensate from the condenser hotwells and pump it through the air ejector condensers (air removal system), gland seal condenser (condensate drains system), and condensate demineralizers (condensate filter demineralizer system) to the suction of three one-third capacity condensate booster pumps. The booster pumps supply two parallel streams, each with five stages of FW heaters, which supply the RF pumps (RF system). The failure of nonsafety-related SSCs in the MC system potentially could prevent the satisfactory accomplishment of a safety-related function. LRA Tables 2.3.4-1 and 2.3.4-2-8 identify MC system component types within the scope of license renewal and subject to an AMR.

The staff reviewed LRA Section 2.3.4.1, USAR Sections XI-3.0 and XI-8.0, and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.3.4.1-MC-1, dated July 16, 2009, the staff identified areas in the turbine building in the license renewal drawings that included fluid-filled components, but were not highlighted as being within the scope of license renewal in accordance with10 CFR 54.4 (a)(2). On license renewal drawing 2004, sheet 2, the applicant shows the 6-inch CH-3 piping (location G-9) and 16-inch CH-3 piping (locations E-9 and G-12) transitioning from the yard to the turbine building as not being within the scope of license renewal. On license renewal drawing 2004, sheet 2 (location B-2), the applicant shows 6-inch CH-2 piping transitioning from the "Turbine Building" into the "Turbine Building Basement." The applicant highlighted the piping as being within the scope of license renewal, in accordance with 10 CFR 54.4 (a)(2), after the line transitions into the basement, but did not highlight the line while it is in the turbine building. The staff requested justification of excluding these segments of piping related to the MC system and located in the turbine building from being within the scope of license renewal in accordance with 10 CFR 54.4 (a)(2).

In its response dated August 17, 2009, the applicant stated that:

> …the non-highlighted piping (6-inch CH-3 and 16-inch CH-3) shown on drawing LRA-2004-SH02 (G/E-9 and G-12) is located in the turbine building basement." Failure of these components cannot prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a)(1). Therefore, these component types are not subject to an AMR in accordance with10 CFR 54.4(a)(2).

The applicant also clarified that the boundary identification designations on license renewal drawing LRA-2004, sheet 2 (location B-2), for "Turbine Building" and "Turbine Building Basement" should be reversed to correctly specify the portion of piping that should be within the scope of license renewal at that location.

Based on its review, the staff finds the response to RAI 2.3.4.1-MC-1 acceptable because the applicant clarified the segments of piping related to the MC system in the turbine building that should be within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.4 (a)(2). The applicant also provided a correction to the drawing designation in its response to appropriately capture the segments of piping that should be within the scope of license renewal. Therefore, the staff's concern described in RAI 2.3.4.1-MC-1 is resolved.

In RAI 2.3.4.1-MC-2, dated July 16, 2009, the staff identified on license renewal drawing 2004, sheet 2 (location B-8), that the applicant highlighted 24-inch condensate piping (24-inch CH-3) in yellow as being within the scope of license renewal in accordance with 10 CFR 54.4 (a)(2). However, when the piping continues at location G-5 of the same license renewal drawing, the piping is no longer highlighted. The staff requested that the applicant provide justification of excluding the 24-inch CH-3 piping and its associated condensate booster pumps from being within the scope of license renewal.

In its response dated August 17, 2009, the applicant stated that:

> …the piping that provides suction to the condensate booster pumps as shown on drawing LRA-2004-SH02 (G-5) is located in the turbine basement. These components were evaluated as described in the response to RAI 2.1-1. Failure of these components cannot prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a)(1). Therefore, these component types are not subject to an AMR in accordance with10 CFR 54.4(a)(2)..

The applicant also clarified that the boundary identification designations on license renewal drawing LRA-2004, sheet 2 (location B-2), for "Turbine Building" and "Turbine Building Basement" should be reversed to correctly specify the portion of piping that should be within the scope of license renewal at that location.

Based on its review, the staff finds the response to RAI 2.3.4.1-MC-2 acceptable because the applicant clarified that the 24-inch CH-3 piping and its associated components are not within the scope of license renewal and subject to an AMR due to its location in the turbine building basement where it cannot adversely affect safety-related components. Therefore, the staff's concern described in RAI 2.3.4.1-MC-2 is resolved.

In RAI 2.3.4.1-MC-3, dated July 16, 2009, the staff identified, on license renewal drawing 2004, sheet 3, the condensate flowing through the FW heater trains, which are highlighted as within the scope of license renewal. LRA Table 2.3.4-2-8 includes the component type "Heat Exchanger Shell" to account for steam side of the FW heaters, but did not account for an environment of steam. Typical FW heaters have end bells attached to both sides of the shell, which contains the same fluid that is in the tubes, but it is a separate component from the heat exchanger shell. LRA Table 2.3.4-2-8 does not include a component type describing the heat exchanger end bells. In one other LRA table (Table 2.3.3-11), the applicant identified "Heat Exchanger (bonnet)" as the component type for end bells. The staff requested the applicant to justify the exclusion of the component type "Heat Exchanger End bells" from LRA Table 2.3.4-2-8 in accordance with 10 CFR 54.21.

In its response dated August 17, 2009, the applicant stated that: "the feedwater heaters have end bells or bonnets that are in-scope and subject to an AMR based on the criterion of 10 CFR 54.4(a)(2)." The applicant also provided revisions to LRA Tables 2.3.4-2-8 and

3.4.2-2-8 to correct the omission of the component type “Heat Exchanger (bonnet)” for the MC system.

Based on its review, the staff finds the response to RAI 2.3.4.1-MC-3 acceptable because the applicant provided additional supplemental information indicating that the heat exchanger end bells are within the scope for license renewal and subject to an AMR in accordance with 10 CFR 54.4 (a)(2). Therefore, the staff’s concern described in RAI 2.3.4.1-MC-3 is resolved.

In RAI 2.3.4.1-MC-4, dated July 16, 2009, the staff identified, on license renewal drawing 2005, sheet 1 (locations E-8 and E-10), two sets of pipe extending out from each of the two main condensers into what is assumed the “turbine building” labeled as 4-inch V2IIF-222, 4-inch V2IIF-223, 4-inch V211F-224, and 4-inch V211F-225. These piping lines are not highlighted, however, the other piping and components near these lines on the license renewal drawing are highlighted as being within the scope of license renewal in accordance with 10 CFR 54.4 (a)(2). The staff requested that the applicant justify the exclusion of the four piping segments from being within the scope of license renewal and subject to an AMR.

In its response dated August 17, 2009, the applicant stated that:

> …the valves MC-V-222, 223, 224, 225 and associated drain piping for condensers 1A and 18 are located in the turbine building basement. Failure of these components cannot prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a)(1). Therefore, these component types are not subject to an AMR based on the criterion of 10 CFR 54.4(a)(2). Other piping and components on this drawing in the near vicinity that are highlighted are associated with lines that penetrate the condensers at higher turbine building elevations not in the basement.

Based on its review, the staff finds the response to RAI 2.3.4.1-MC-4 acceptable because the applicant clarified that the four piping lines and its associated components are located where they cannot affect safety-related components. Therefore, the staff’s concern described in RAI 2.3.4.1-MC-4 is resolved.

The staff reviewed the LRA, USAR, RAI responses, and boundary drawings to determine whether or not the applicant failed to identify any components within the scope of license renewal. In addition, the staff determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes the applicant has appropriately identified the MC system mechanical components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and that the applicant has adequately identified the MC system mechanical components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

<u>Main Steam</u>. LRA Section 2.3.4.1 describes the MS system, which conducts steam from the RV through the PC to the main turbine and other components that use reactor steam. Four steam lines conduct steam from the reactor through a shielded pipe tunnel to a pressure equalizing header. Two main branches from the header go to the main turbine and one branch to the main turbine bypass valve manifold, which discharges to the condenser. Reactor steam is also supplied to the HPCI and RCIC turbines, reactor feed pump turbines, the steam jet air ejectors, main turbine and reactor feed pump turbine gland seals, and the augmented OG system (for hydrogen dilution). Drain lines are connected to the low points of each MS line both inside and outside the drywell.

The MS system includes the nuclear boiler system pressure relief system, consisting of three safety valves and eight S/RVs located on the MS lines inside the drywell, before the first MSIV. The safety valves and S/RVs prevent overpressurization of the RCPB. The spring-loaded safety valves discharge directly to the drywell. The pilot-operated S/RVs discharge to the suppression pool. S/RV discharge is piped through individual discharge lines to T-quenchers located below the minimum water level in the suppression pool. Two 10-inch vacuum relief valves are provided on each S/RV discharge line in the drywell to prevent drawing water up into the line due to steam condensation following termination of relief valve operation. The MS system also provides steam to the RHR heat exchangers for the steam condensing mode of RHR system operation. This mode has been operationally abandoned and the steam supply isolated; however, valves in the MS system still support the RHR system pressure boundary.

The MS system contains safety-related components relied upon to remain functional during and following DBEs. The failure of nonsafety-related SSCs in the MS system potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the MC system performs functions that support fire protection and SBO. LRA Tables 2.3.1-3, 2.3.2-1, 2.3.2-3, 2.3.4-1, and 2.3.4-2-9 identify MS system component types within the scope of license renewal and subject to an AMR.

The staff reviewed LRA Section 2.3.4.1, USAR Sections IV-4.0, IV-5.0, IV-6.0, IV-11.0, VI-4.2 (ADS), and XI-5.0 (turbine bypass), and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.3.4.1-MS-1, dated July 16, 2009, the staff identified on license renewal drawing LRA-2002, sheet 2, that the moisture separator/reheaters have individual level indicator tanks (MI-A/B/C/D) and are highlighted yellow, which indicates the tanks are within the scope of license renewal in accordance with 10 CFR 54.4 (a)(2). However, LRA Table 2.3.4-2-9 for the MS system does not list the component types "Pressure Vessel" or "Tank" to represent the individual level indicator tanks. Also, Table 2.3.4-2-9 does not include such component types as "Sight Glass" or "Level Indicator." The staff requested that the applicant provide justification for the exclusion of the component type "Tank" from LRA Table 2.3.4-2-9, and clarify if the tanks have level instrumentation that would require the component type "Level Gage" be included within the scope of license renewal and subject to an AMR.

In its response dated August 17, 2009, the applicant stated that "the MI-A/B/C/D are not tanks, but are calorimeter units integrated into the system piping." The applicant included these calorimeter units within component type "Piping" in LRA Table 2.3.4.2-9. The applicant also shows on license renewal drawing LRA-2002, sheet 2, that the moisture separators are equipped with level switches as part of the calorimeter assemblies, thus making it unnecessary for the applicant to list component type "Level Gage" in LRA Table 2.3.4-2-9.

Based on its review, the staff finds the response to RAI 2.3.4.1-MS-1 acceptable because the applicant clarified the components, MI-A/B/C/D, as calorimeter units equipped with level switches as opposed to tanks. These components are included on LRA Table 2.3.4-2-9 as being within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.4 (a)(2). Therefore, the staff's concern described in RAI 2.3.4.1-MS-1 is resolved.

In RAI 2.3.4.1-MS-2, dated July 16, 2009, the staff noted that the applicant takes credit for and identifies the MSIV leakage pathway within the scope of license renewal up to isolation valves; however, the applicant did not identify seismic supports or boundaries for the piping that may be past the isolation valves or to the next base-mounted equipment. During the staff's plant audit for license renewal in May 2009, the staff's visual walkdown of the turbine building could not confirm a seismic support near an isolation valve (the MSIV leakage pathway license renewal boundary) to the turbine FW pump. The staff requested that the applicant verify that the seismic supports and piping needed to credit the MSIV pathway are included within the scope of license renewal and subject to an AMR.

In its response dated August 17, 2009, the applicant performed an additional review of the MSIV leakage pathway pressure boundary to determine if additional components not already within the scope of license renewal and subject to an AMR are required for structural support of MSIV leakage pathway components. The applicant determined that additional components needed to be included to account for the structural support for overall MSIV leakage pathway components. As a result of this review, the applicant indicated that all seismic supports and piping needed for the MSIV leakage pathway are included within the scope of license renewal and subject to an AMR.

Based on its review, the staff finds the response to RAI 2.3.4.4-MS-2 acceptable because the applicant conducted a secondary review of the MSIV leakage pathway and included the additional components that account for the seismic support and boundaries for the MSIV leakage pathway within the scope of license renewal and subject to an AMR. Therefore, the staff's concern described in RAI 2.3.4.1-MS-2 is resolved.

The staff reviewed the LRA, USAR, RAI responses, and boundary drawings to determine whether or not the applicant failed to identify any components within the scope of license renewal. In addition, the staff determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes the applicant has appropriately identified the MS system mechanical components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and that the applicant has adequately identified the MS system mechanical components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.3.4.1.3 Conclusion

The staff reviewed the LRA, USAR, RAI responses, and boundary drawings to determine whether the applicant failed to identify any components within the scope of license renewal. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes the applicant has appropriately identified the MSIV leakage pathway mechanical components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and that the applicant has appropriately identified the MSIV leakage pathway mechanical components subject to an AMR in accordance with 10 CFR 54.21(a)(1).

2.3.4.2 *Steam and Power Conversion Systems In-Scope for 10 CFR 54.4(a)(2)*

2.3.4.2.1 Summary of Technical Information in the Application

LRA Section 2.3.4.2 describes the steam and power conversion 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: (1) a functional failure where the failure of a nonsafety-related SSC to perform its function impacts a safety function or (2) a physical failure where a safety function is impacted by the loss of structural or mechanical integrity of an SSC in physical proximity to a safety-related component. LRA Section 2.3.4.2 states that functional failures of nonsafety-related SSCs, which could impact a safety function, are identified in previous LRA sections. LRA Table 2.3.4.2-A shows systems within the scope of license renewal with potential for physical interactions with safety-related components. Of these systems, the following are not described elsewhere in the LRA:

- circulating water
- condensate drains
- condensate filter demineralizer
- condensate makeup
- extraction steam
- reactor feedwater
- reactor feedwater pump and turbine lube oil
- turbine generator
- turbine generator electro-hydraulic fluid
- turbine generator lube oil
- turbine lube oil instruments

2.3.4.2.2 Staff Evaluation

Circulating Water. The staff reviewed LRA Section 2.3.4.2A, USAR Section XI-6.0, and the license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.3.4.2.CW-1, dated July 16, 2009, the staff noted that license renewal drawing LRA-2006-SH03, Zone A/B-8, show strainers attached to a functional 10 CFR 54.4(a)(2) component (condenser) and with piping identified as within the scope of license renewal in accordance with 10 CFR 54.4(a)(2) for physical interaction. The strainers are not identified as within the scope of license renewal. The applicant was requested to provide a basis for not including the strainers within the scope of license renewal.

In its response dated August 16, 2009, the applicant stated that subject strainers are within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The applicant provided revised LRA Tables 2.3.4-2-1 and 3.4.2-2-1 reflecting these additions.

Based on its review, the staff finds the response to RAI 2.3.4.2.CW-1 acceptable because the applicant explained that the subject strainers are within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.4(a)(2). The staff confirmed that the applicant revised LRA Tables 2.3.4-2-1 and 3.4.2-2-1 to include the strainers.

The staff reviewed the LRA, USAR, RAI responses, license renewal drawings, and revised LRA tables to determine whether or not the applicant failed to identify any components within the scope of license renewal. In addition, the staff determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes the applicant has appropriately identified the circulating water system mechanical components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and that the applicant has adequately identified the circulating water system mechanical components subject to an AMR, in accordance with 10 CFR 54.21(a)(1) (i.e., "For those systems, structures, and components within the scope of this part, as delineated in 54.4, identify and list those structures, and components subject to an aging management review").

Condensate Drains. LRA Section 2.3.4.2 describes the condensate drain (CD) system, which increases steam plant efficiency by preheating the incoming FW and thereby reducing the reactor plant heat load. LRA Table 2.3.4-2-2 identifies CD system component types within the scope of license renewal and subject to an AMR.

The staff reviewed LRA Section 2.3.4.2, USAR Section XI-8.0 (CD and FW system) and XI-4.0 (turbine sealing system), and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.3.4.2-CD-1, dated July 16, 2009, the staff identified that the applicant indicated a component type labeled "FX" on license renewal drawing LRA-2008, sheet 1, on the heater drain piping. "FX" is referred to as a flow test device and was not listed as a component type in LRA Table 2.3.4-2-2 for the CD system. The staff requested that the applicant describe the flow test device and its applicability to LRA Table 2.3.4-2-2 as one of the component types to be included.

In its response dated August 17, 2009, the applicant stated that the "FX" components labeled on license renewal drawing LRA-2008, sheet 1, are nonsafety-related flow test spool pieces used as a connection interface for installation of temporary diagnostic instruments. The applicant also stated that the flow test spool pieces are included as part of component type "Piping" in LRA Table 2.3.4-2-2.

Based on its review, the staff finds the response to RAI 2.3.4.2-CD-1 acceptable because the applicant explained the purpose of the flow test device and noted its inclusion in LRA Table 2.3.4-2-2 as being within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.4 (a)(2). Therefore, the staff's concern described in RAI 2.3.4.2-CD-1 is resolved.

The staff reviewed the LRA, USAR, RAI responses, and boundary drawings to determine whether or not the applicant failed to identify any components within the scope of license renewal. In addition, the staff's review determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes the applicant has appropriately identified the CD system mechanical components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and that the applicant has acceptably identified the CD system mechanical components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

Condensate Filter Demineralizer. LRA Section 2.3.4.2 describes the condensate filter demineralizer (CF) system, which maintains the required purity of FW to the reactor. The system includes seven demineralizer units; five are required to provide full flow. The demineralizers remove contaminants from the FW by mechanical filtration and ion exchange. LRA Table 2.3.4-2-3 identifies CF system component types within the scope of license renewal and subject to an AMR.

The staff reviewed LRA Section 2.3.4.2, USAR Section XI-7.0, and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.3.4.2-CF-1, dated July 16, 2009, the staff noted that the applicant identified the CF system is within the scope of license renewal in accordance with 10 CFR 54.4(a)(2) for potential spatial interaction and listed piping and valves as components subject to an AMR. However, the staff could not identify the components related to this system on license renewal drawing LRA-2049, sheet 4. The staff requested that the applicant identify the CF components within the scope of license renewal and provide the appropriate drawing of the CF system showing the in-scope components in order for the staff to verify that components were not omitted from the scope of license renewal.

In its response dated August 17, 2009, the applicant stated that "the CNS component database was the main information source used to determine the components assigned to the CF system that are in-scope and subject to an AMR in accordance with 10 CFR 54.4(a)(2) for spatial interaction." The applicant made the determination of components being within the scope of license renewal relative to their locations near safety-related equipment. The applicant indicated that those in-scope components subject to an AMR include valve body and piping components, which are shown on license renewal drawing LRA-2049, sheet 4 (location B/C-5). However, upon further review, the staff could not readily identify the components that comprise the CF system at that drawing location. In addition, the applicant indicated that on license renewal drawing LRA-2004, sheet 2, the transition from the MC system to the CF system occurs at the radwaste building wall. The applicant's review of the CNS component database found that the majority of the CF system components are located in the radwaste building. The radwaste building contains no safety-related components, therefore, the applicant determined that the components located in the radwaste building were not subject to an AMR in accordance with 10 CFR 54.4 (a)(2).

Based on the applicant's response to RAI 2.3.4.2-CF-1, the staff did not find the applicant's explanation acceptable for the staff to complete the review for the CF system. Therefore, the staff submitted RAI 2.3.4.2-CF-2 to the applicant, dated October 29, 2009, stating that the applicant needed to provide clarification of the components that comprise the CF system and their spatial interaction with any safety-related systems.

In its response to RAI 2.3.4.2 CF-2, dated November 30, 2009, the applicant stated that the CF system components that are in-scope and subject to an AMR based on 10 CFR 54.4(a)(2) for spatial interaction are located in the reactor building and are included in LRA Table 3.4.2-2-3, "Condensate Filter Demineralizer System." The highlight components shown on the drawing associated with the CF system were the CF valve bodies and the associated downstream piping, which continues onto another LRA drawing where it enters the torus area and is highlighted up to the torus/radwaste building wall. In a teleconference with the staff on January 8, 2010, the applicant further clarified that the highlighted piping depicts the CF system flow upstream from the 24-inch condensate header to the CF demineralizer supply in the radwaste building. The applicant also indicated that the additional CF components, which consist of 54 valve bodies and associated bolting, piping, and tubing, are in-scope and subject to an AMR based on 10 CFR 54.4(a)(2) for spatial interaction. However, these components could not be captured on the LRA drawings since they are provided in instrumentation detail drawings.

The staff's review of the applicant's response to RAI 2.3.4.2 CF-2 found the response acceptable, because it identified where the in-scope components of the CF were located on LRA drawings and summarized the component types that were not shown on LRA drawings, but were included within the scope of license renewal. Therefore, the staff's concern described in RAI 2.3.4.2 CF-2 is resolved.

The staff reviewed the LRA, USAR, RAI responses, and boundary drawings to determine whether the applicant failed to identify any components within the scope of license renewal. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes the applicant has appropriately identified the CF system mechanical components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the CF system mechanical components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(2).

Condensate Makeup. The staff reviewed LRA Section 2.3.4.2D, USAR Section XI-9.0, and the license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.3.4.2.CM-1, dated July 16, 2009, the staff noted that license renewal drawing LRA-2049 sheet 2, Zone D-9, shows overflow piping coming off vent piping 4-inch CH-4 on emergency CST 1A to the overflow piping continuing to the control building sump. The vent piping is shown within the scope of license renewal in accordance with 10 CFR 54.4(a)(1). There is no similar overflow line on the ECST 1B. The applicant was requested to justify the exclusion of the 4-inch overflow line from the scope of license renewal and to confirm whether or not there is a similar overflow line on tank 1B.

In its response dated August 16, 2009, the applicant stated that the 4-inch overflow line is within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.4(a)(2). Also, tank 1B does not have a similar overflow line due to an equalizing line joining tanks 1A and 1B.

Based on its review, the staff finds the response to RAI 2.3.4.4.CM-1 acceptable because the applicant explained that the subject line is within the scope of license renewal in accordance with 10 CFR 54.4(a)(2), and subject to an AMR. The applicant also explained that there is no similar line on tank 1B due to a compensation line joining the two tanks.

In RAI 2.3.4.4.CM-2, dated July 16, 2009, the staff noted that license renewal drawing LRA-2049, sheet 2, Zone D-9, shows a possible equalization line, 6-inch CH-4, connecting emergency condensate storage tank (ECST) 1A and 1B, as within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The ECSTs are within the scope of license renewal in accordance with 10 CFR 54.4(a)(1). The applicant was requested to provide a basis for the possible equalization line as within the scope of license renewal in accordance with 10 CFR 54.4(a)(2) rather than within the scope of license renewal in accordance with 10 CFR 54.4(a)(1).

In its response dated August 16, 2009, the applicant stated the equalization line connecting the emergency condensate tanks is within the scope of licensing renewal and subject to an AMR in accordance with 10 CFR 54.4(a)(1).

Based on its review, the staff finds the response to RAI 2.3.4.4.CM-2 acceptable because the applicant stated that the equalization line is within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.4(a)(1).

In LRA Section 2.3.4.2, the applicant indicated that the CM system has the intended function in accordance with 10 CFR 54.4(a)(1) to provide water to the ECCS systems. The applicant indicated that the ECSTs and CM system components that support the HPCI system pressure boundary are reviewed with the HPCI system in LRA Section 2.3.2.4. There were no specific CM components highlighted in a unique color designation to support this (a)(1) function. However, the staff noted in USAR Chapter XIV, Section 6.4, the applicant credits the flow path from CST 1A to the CS and RHR pumps when the suppression pool is drained in response to USNRC IE Bulletin No. 84-03, August 24,1984. The USAR evaluation concluded that upon a loss of refueling cavity inventory due to a seal failure, the CS and/or the RHR systems would allow the operators ample time to place fuel in a safe location per their emergency operating procedures. CNS technical specifications allow refueling operations to be conducted with the suppression pool drained, provided an operable CS or LPCI subsystem is aligned to take a suction on CST 1A, containing at least 150,000 gallons. However, the applicant did not identify CST 1A, nor the flow path from CST 1A (16-inch CH-4) as being within the scope of license renewal, and only identifies selected in-scope piping (14-inch CH-4) in accordance with CFR 54.4(a)(2). Therefore, the staff submitted RAI 2.3.4.2-CM-3, dated October 29, 2009, stating that the applicant needs to provide justification for the exclusion of the applicable components in the CM system for the scope of license renewal used to provide ECCS with water.

In its response to RAI 2.3.4.2-CM-3, dated November 30, 2009, the applicant stated that the technical specifications (TSs) for ECCS in shutdown conditions apply in modes 4 and 5, unless the spent fuel storage pool gates are removed and the vessel water level is greater than 21 feet above the RV flange. With the gates removed and water level above 21 feet, the ECCS is not required by TS, and CST 1A would not be credited. Fuel would only be uncovered in the event of a bellows failure during fuel movement. Fuel movement is only performed under the conditions where the gates are removed and water level is above 21 feet. Therefore, the applicant's position is that CST 1A would not be credited during fuel movement.

The staff reviewed the applicant's response to RAI 2.3.4.2-CM-3 and finds the response does not meet the acceptance criteria for including SSCs within the scope of license renewal under 10 CFR 54.4. The staff understands the applicant's position that ECCS is not required by TS during refueling when the gates are removed and water level is above 21 feet. However, the TSs and USAR allow the applicant to credit the use of the CST during mode 4 and mode 5 shutdown operations. As stated in LRA and USAR, the CST can function as a secondary source of water for the core spray and low pressure injection pumps during refueling operations to provide core reflooding capability. If the suppression pool were drained, then the CST would be the only source of water for the ECCS systems. Additionally, LRA Section 2.3.2.1, "Residual Heat Removal," specifies that RHR can perform a 10 CFR 54.4(a)(2) function to provide alternate water supply to the spent fuel pool, where the CST is one of the sources of makeup water. When employed as such, the CST supports a safety function by providing a source of water to the ECCS systems for core cooling/makeup and the RHR system for fuel storage cooling/makeup.

Therefore, consistent with the scoping requirement of 10 CFR 54.4(a)(2), the CST is a component whose failure could prevent satisfactory accomplishment of a 10 CFR 54.4(a)(1)(ii) function. Given the cases shown above where the CST1A is relied upon during ECCS systems operation, the staff finds that the CST can be used as a viable and allowable option for the applicant to use during shutdown operations to support a safety function; hence, the CST should be included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). This is an open item OI 2.3.4.2-1.

The staff reviewed the LRA, USAR, RAI responses, and license renewal drawings to determine whether or not the applicant failed to identify any components within the scope of license renewal. In addition, the staff determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, pending resolution of the open item, the staff cannot conclude that: (a) the applicant has appropriately identified the CM system mechanical components within the scope of license renewal in accordance with 10 CFR 54.4(a), and (b) the applicant has adequately identified the CM system mechanical components subject to an AMR in accordance with 10 CFR 54.21(a)(1).

Extraction Steam. LRA Section 2.3.4.2 describes the ES system, which increases steam plant efficiency by preheating incoming FW and thereby reducing the reactor plant heat load. Steam is conducted from main turbine connections to the two parallel FW heater strings to preheat the FW. LRA Table 2.3.4-2-5 identifies ES system component types within the scope of license renewal and subject to an AMR.

The staff reviewed LRA Section 2.3.4.2, USAR Section XI-2.0, and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff's review identified areas in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAIs as discussed below.

In RAI 2.3.4.2-ES-1, dated July 16, 2009, the staff identified that the applicant highlighted FW heaters on license renewal drawing 2003 as being within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). However, LRA Table 2.3.4-2-5 for the ES system, does not list a component type to represent the FW heaters. LRA Table 2.3.4-2-8, for the MC system, shows the component type "Heat Exchanger (shell)"; however, the table only shows an internal environment of treated water as opposed to steam. The staff requested that the applicant justify the exclusion of the component type "Feedwater Heaters (shell side)" from Table 2.3.4-2-5 for the ES system.

In its response dated August 17, 2009, the applicant stated that: "the feedwater heaters are assigned to the MC system and are listed as component type 'Heat Exchanger (shell)' in LRA Table 2.3.4-2-8 (main condensate system). The environment of steam on heat exchanger shells should be included in the evaluation of MC system component types." The applicant revised LRA Table 3.4.2-2-8 accordingly.

Based on its review, the staff finds the response to RAI 2.3.4.2-ES-1 acceptable because the applicant revised the LRA table for the MC system to include "Heater Exchanger (shell)" as related to the steam environment. Therefore, the staff's concern described in RAI 2.3.4.2-ES-1 is resolved.

In RAI 2.3.4.2-ES-2, dated July 16, 2009, the staff identified that the applicant highlighted on license renewal drawing 2002, sheet 2 (location C-7), a piping run of 8-inch AS-2 coming from the auxiliary boilers and ending in a blind flange, which would indicate that portion as being within the scope of license renewal. However, the 8-inch AS-2 piping is further shown from the blind flange location not highlighted and possibly protruding onto the 932-foot turbine building elevation. The staff requested that the applicant justify the exclusion of 8-inch AS-2 piping after the blind flange from being within the scope of license renewal.

In its response dated August 17, 2009, the applicant stated that:

> …the non-highlighted piping and components opposite the blind flange are high energy components located in the turbine building basement assigned to the ES system. These components are in-scope and subject to an AMR based on the criterion of 10 CFR 54.4(a)(2) as discussed in the response to RAI 2.1-1. The components are included as component types “Piping” and “Valve body” in LRA Table 2.3.4-2-5 (Extraction Steam System).

Based on its review, the staff finds the response to RAI 2.3.4.2-ES-2 acceptable because the applicant clarified that the 8-inch AS-2 piping segment from the blind flange into the turbine building basement is within the scope of license renewal and subject to an AMR in accordance with 10 CFR 54.4 (a)(2). Therefore, the staff’s concern described in RAI 2.3.4.2-ES-2 is resolved.

The staff reviewed the LRA, USAR, RAI responses, and boundary drawings to determine whether or not the applicant failed to identify any components within the scope of license renewal. In addition, the staff determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes the applicant has appropriately identified the ES system mechanical components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and that the applicant has adequately identified the ES system mechanical components subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

Reactor Feedwater. LRA Section 2.3.4.2 describes the RF system, which provides a dependable supply of FW to the reactor. The RF system consists of two parallel trains, each with a one-half capacity turbine driven reactor feed pump with associated piping and valves. FW piping conducts water from outside PC to the RV, where it is distributed by FW spargers. The RF system contains safety-related components relied upon to remain functional during and following DBEs. In addition, the RF system performs functions that support fire protection and SBO. LRA Table 2.3.4-2-10 identifies RF system component types within the scope of license renewal and subject to an AMR.

Based on the results of the staff evaluation discussed in Section 2.3 and review of the LRA, USAR, and RF system boundary drawings, the staff concludes that the applicant has appropriately identified the RF system mechanical components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the system components subject to an AMR in accordance with 10 CFR 54.21(a) (2).

Reactor Feedwater Pump and Turbine Lube Oil. LRA Section 2.3.4.2 describes the reactor feedwater pump and turbine lube oil (RFLO) system. The purpose of the RFLO system is to provide lubricating and hydraulic fluid to the FW pump bearings, turbine bearings, and the stop and nozzle valve assemblies.

The failure of nonsafety-related SSCs in the RFLO system potentially could prevent the satisfactory accomplishment of a safety-related function. LRA Table 2.3.4-2-11 identifies the RFLO system component types within the scope of license renewal and subject to an AMR.

The staff reviewed LRA Section 2.3.4.2 and the license renewal boundary drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff noted that the applicant did not describe and justify the methods used to identify and list those SSCs in the RFLO system subject to an AMR. Therefore, the staff submitted RAI 2.3.4.2.RFLO-1 asking the applicant to provide drawings of the complete RFLO system showing portions within the scope of license renewal and which components are subject to an AMR; or provide a description and justification of the methods used to determine which SCs of the RFLO system are subject to an AMR.

In its response dated August 17, 2009, the applicant stated that the CNS component database was used to determine the components with potential for spatial interaction with safety-related equipment. The applicant indicated that some of these components are not shown on CNS drawings. The applicant further indicated that with the RF pumps in the turbine building basement, many components of the RFLO system are also in the turbine building basement and failure of these components cannot prevent satisfactory accomplishment of the functions identified in 10 CFR 54.4(a)(1) and are, therefore, not subject to an AMR. The passive mechanical components of the RFLO system located in areas containing safety-related equipment are associated with instrumentation support and are listed in LRA Table 2.3.4-2-11.

The staff finds the response to RAI 2.3.4.2.RFLO-1 acceptable because the applicant has provided a description and justification as to the method used to determine which SSCs of the RFLO system are subject to an AMR and has identified them in LRA Table 2.3.4.2-11.

The staff reviewed the LRA, USAR, RAI response, and license renewal drawings to determine whether the applicant failed to identify any components within the scope of license renewal. In addition, the staff's review determined whether or not the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes that the applicant has appropriately identified the RFLO system mechanical components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and that the applicant has adequately identified the RFLO system mechanical components subject to an AMR in accordance with 10 CFR 54.21(a)(2)

Turbine Generator. LRA Section 2.3.4.2 describes the turbine generator (TG) system. The purpose of the TG system is to receive steam from the BWR and convert the steam energy to electrical power and provide ES and moisture for FW heating.

The failure of nonsafety-related SSCs in the TG system potentially could prevent the satisfactory accomplishment of a safety-related function. The TG provides a 10 CFR 54.4(a)(2) function by providing missile protection from turbine missiles. The turbine casing provides the missile barrier protection. LRA Table 2.3.4-2-12 identifies the TG system component types within the scope of license renewal and subject to an AMR.

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

Turbine Generator Electro-Hydraulic Fluid. LRA Section 2.3.4.2 describes the turbine generator electro-hydraulic fluid (TGF) system. The purpose of the TGF system is to provide the hydraulic fluid used to operate the main turbine system valves during normal and emergency operations.

The failure of nonsafety-related SSCs in the TGF system potentially could prevent the satisfactory accomplishment of a safety-related function. LRA Table 2.3.4-2-13 identifies the TGF system component types within the scope of license renewal and subject to an AMR.

The staff reviewed LRA Section 2.3.4.2 and USAR Sections VII-11.0 and XI-2.0 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff noted that the applicant did not describe and justify the methods used to identify and list those SSCs in the RFLO system (associated with TGF system) subject to an AMR. Therefore, the staff submitted RAI 2.3.4.2.TGF-1 asking the applicant to provide drawings of the complete TGF system showing portions within the scope of license renewal and which components are subject to an AMR; or provide a description and justification of the methods used to determine which SCs of the TGF system are subject to an AMR.

In its response dated August 17, 2009, the applicant stated that it used the CNS component database to determine the components with potential for spatial interaction with safety-related equipment. The applicant stated that TGF components are shown on vendor drawings and are not suitable for license renewal drawings. The applicant further stated that all passive mechanical fluid-filled components assigned to the TGF system are located in spaces that contain safety-related equipment, and are therefore within the scope of license renewal and subject to an AMR. The component types are listed in LRA Table 2.3.4-2-13.

The staff finds the response to RAI 2.3.4.2.TGF-1 acceptable because the applicant has provided a description and justification as to the method used to determine which SSCs of the TGF system are subject to an AMR and has identified them in Table 2.3.4-2-13.

The staff reviewed the LRA, USAR, RAI response, and license renewal drawings to determine whether the applicant failed to identify any components within the scope of license renewal. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes that the applicant has appropriately identified the TGF system mechanical components within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the TGF system components subject to an AMR in accordance with 10 CFR 54.21(a)(2).

<u>Turbine Generator Lube Oil</u>. LRA Section 2.3.4.2 describes the turbine generator LO system. The purpose of the turbine generator LO system is to lubricate the journal bearings and thrust bearing associated with the main turbine and generator, and provide trip protection to the main turbine.

The failure of nonsafety-related SSCs in the turbine generator LO system potentially could prevent the satisfactory accomplishment of a safety-related function. LRA Table 2.3.4-2-6 identifies the turbine generator LO system component types within the scope of license renewal and subject to an AMR.

The staff reviewed LRA Section 2.3.4.2 and the boundary drawing using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The applicant identified many of the turbine generator LO system components on the boundary drawing, but the staff noted that the applicant did not describe and justify the methods used to identify and list those SSCs that are in the turbine generator LO lines to the journal bearings, thrust bearing, and turbine trip protection that are subject to an AMR. Therefore, the staff submitted RAI 2.3.4.2.LO-1 asking the applicant to provide drawings of the complete turbine generator LO system showing portions within the scope of license renewal and which components are subject to an AMR; or provide a description and justification of the methods used to determine which SCs of the turbine generator LO system are subject to an AMR.

In its response dated August 17, 2009, the applicant stated that it used the CNS component database to determine the components with potential for spatial interaction with safety-related equipment. The applicant stated that some of these components are not shown on license renewal drawings. The applicant further stated that many components of the turbine generator LO system are in the turbine building basement and that failure of these components cannot prevent satisfactory accomplishment of the functions identified in 10 CFR 54.4(a)(1) and are, therefore, not subject to an AMR. The passive mechanical components of the turbine generator LO system located in areas containing safety-related equipment which support main turbine and generator bearing operation and are listed in LRA Table 2.3.4-2-6.

The staff finds the response to RAI 2.3.4.2. LO-1 acceptable because the applicant has provided a description and justification as to the method used to determine which SSCs of the turbine generator LO system are subject to an AMR and has identified them in Table 2.3.4-2-6.

The applicant did not list the seal oil system for the main generator to be within the scope of license renewal although the turbine building, which houses the seal oil system, is within the scope of license renewal because it contains SSC that are safety-related. Therefore the staff submitted RAI 2.2-2 requesting that the applicant justify excluding the main generator seal oil system from the scope of license renewal.

In its response dated May 28, 2009, the applicant stated that component types supplying seal oil to the main generator are associated with the turbine generator LO system, which is within the scope of license renewal in accordance with 10 CFR 54.4 (a)(2). Component types associated with the seal oil portion of the LO system are subject to an AMR and listed in LRA Table 2.3.4-2-6.

Based on its review, the staff found the response to RAI 2.2-2 acceptable because the applicant identified that the components of the seal oil system were included within the generator LO system and subject to an AMR.

The staff reviewed the LRA, USAR, RAI response, and license renewal drawings to determine whether the applicant failed to identify any components within the scope of license renewal. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes the applicant has appropriately identified the LO system mechanical components within the scope of license renewal in accordance with 10 CFR 54.4(a), and that the applicant has adequately identified the LO system component subject to an AMR in accordance with 10 CFR 54.21(a)(2).

Turbine Lube Oil-Instruments. LRA Section 2.3.4.2 describes the turbine lube oil-instrument (LOGT) system. The purpose of the LOGT system is to provide instrumentation for the turbine generator LO system.

The failure of nonsafety-related SSCs in the LOGT system potentially could prevent the satisfactory accomplishment of a safety-related function. LRA Table 2.3.4-2-7 identifies the LOGT system component types within the scope of license renewal and subject to an AMR. The EIC components are within the scope of license renewal in accordance with LRA Section 2.1.1.

The staff reviewed LRA Section 2.3.4.2 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. The staff noted that the applicant did not describe and justify the methods used to identify and list those SSCs in the LOGT system subject to an AMR. Therefore, the staff submitted RAI 2.3.4.2.LOGT-1 asking the applicant to provide drawings of the complete LOGT system showing portions within the scope of license renewal and which components are subject to an AMR; or provide a description and justification of the methods used to determine which SCs of the RFLO system are subject to an AMR.

In its response dated August 17, 2009, the applicant stated that it used the CNS component database to determine the components with potential for spatial interaction with safety-related equipment. The applicant stated that some of these components are not shown on license renewal drawings. The applicant stated that all passive mechanical components of the LOGT system are located in areas containing safety-related equipment, and therefore are within the scope of license renewal and subject to an AMR.

The staff finds the response to RAI 2.3.4.2.LOGT-1 acceptable because the applicant has provided a description and justification as to the method used to determine which SSCs of the LOGT system are subject to an AMR and has included all passive mechanical components of the LOGT system and has identified them in Table 2.3.4-2-7.

The staff reviewed the LRA, USAR, RAI response, and license renewal drawings to determine whether the applicant failed to identify any components within the scope of license renewal. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff concludes the applicant has appropriately identified the LOGT system mechanical component types within the scope of license renewal in accordance with 10 CFR 54.4(a), and that the applicant has adequately identified the LOGT system components subject to an AMR in accordance with 10 CFR 54.21(a)(2).

2.3.4.2.3 Conclusion

The staff reviewed the LRA, USAR, RAI response, and license renewal drawings to determine whether the applicant failed to identify any components within the scope of license renewal. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. On the basis of its review, the staff can not conclude that the applicant has appropriately identified the steam and power conversion system mechanical component types within the scope of license renewal in accordance with 10 CFR 54.4(a), and that the applicant has appropriately identified the steam and power conversion system components subject to an AMR in accordance with the requirements stated in 10 CFR 54.21(a)(2) until the applicant resolves open item OI 2.3.4.2-1.

2.4 Scoping and Screening Results: Structures

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

- reactor building and PC
- water control structures
- turbine building, process facilities, and yard structures

- bulk commodities

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

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

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

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

2.4.1 Reactor Building and Primary Containment

2.4.1.1 *Summary of Technical Information in the Application*

The reactor building totally encloses the PC, the refueling and reactor servicing areas, the new and spent fuel storage facilities, and other reactor auxiliary systems.

The reactor building serves as PC during reactor refueling and maintenance operations when the PC is open and as an additional barrier when the PC is functional. The reactor building provides an area for alternate shutdown capabilities. The reactor building structure is seismic Class I, constructed of monolithic reinforced concrete floors and walls to the refueling level. A reinforced concrete mat constructed on dense structural fill extends from the bedrock surface to the mat foundation, minimizing settlement of the structure. The reactor building structural steel includes structural framing steel for platform floors and the alternate shutdown room, along with other miscellaneous components.

A biological shield wall, an integral part of the reactor building, surrounds the PC. This reinforced concrete wall serves as the basic biological shield for the reactor building and also protects the PC against potential external missiles. Above the refueling level, the exterior walls consist of steel framing covered by insulated metal siding with sealed joints and insulated steel roof decking. Blowout panels consisting primarily of light-weight cellular concrete are located in the steam pipe chase blockouts of the wall separating the MS tunnel and the turbine building. The MS lines to the turbine generator from the reactor are housed in a reinforced concrete tunnel that enters the turbine building after passing under the adjacent reactor building. The reinforced concrete tunnel walls and roof are designed for radiation shielding. All elevated floors are reinforced concrete framing supported by the exterior walls, the biological shield wall and concrete columns bearing on large supporting beams that span over the top of the torus. Interior walls are reinforced concrete or concrete block. Exterior walls below the refuel floor provide radiation shielding and tornado protection.

The railroad car airlock is adjacent to the reactor building and provides a protected secondary containment access point for large equipment. The railroad airlock is a Class II structure with 12-inch thick concrete walls and roof.

The spent fuel storage pool, reactor cavity, and dryer separator pit in the reactor building consist of reinforced concrete lined with stainless steel plate, providing a leak-proof membrane. The pool liner is seam-welded stainless steel with pipe sleeves welded to the liner plate on both sides of the plate. A drain system between the liner and concrete structure provides for monitoring of the spent fuel pool liner for leaks.

The purpose of the PC, in conjunction with other engineered safeguards, is to limit the release of fission products in the event of a postulated DBA so that offsite doses do not exceed the guideline values in accordance with 10 CFR 100. The PC is a Mark I low-leakage pressure suppression containment design and houses the RV, the reactor recirculating loops, and other branch connections of the RCS.

The major components of the PC include a drywell, a torus (or pressure suppression chamber), and the connecting vent system between the drywell and torus. The drywell houses the RV and associated components. The drywell is a carbon steel structure surrounded by a reinforced concrete biological shield wall. Internal structures consist of a drywell fill slab, reactor pedestal, sacrificial shield wall and its lateral support, and structural steel. The reinforced concrete fill slab in the bottom of the drywell supports the reactor pedestal and other SCs inside the drywell.

A gap separates the drywell from the reactor building reinforced concrete in the area around the cylindrical portion and the spherical portion above the support transition point at the lower radius. The reinforced concrete drywell floor contains the drywell floor drain and equipment drain sumps. The reactor pedestal is a reinforced concrete cylinder supporting the reactor pressure vessel, the sacrificial shield wall, and floor framing.

One personnel access lock is provided for access to the drywell. The lock has two gasketed doors in series. A personnel access hatch is provided on the drywell head. This hatch is bolted in place. The drywell has two equipment access hatches bolted in place. The drywell top head, the two equipment hatches, the drywell and torus manways, the CRD removal hatch, and the stabilizer assembly inspection ports have double-gasketed closures to maintain containment leak tightness.

The torus is located below the drywell and encircles and contains treated (demineralized) water, which forms the suppression pool. The torus is a carbon-steel pressure vessel anchored to and supported by the reinforced concrete foundation slab of the reactor building. A vent system connects the drywell to the torus with vent lines that terminate below the torus water surface. The vent pipes are equipped with expansion joints to accommodate differential motion between the drywell and pressure suppression chamber. Jet deflectors in the drywell at the entrance of each vent pipe prevent damage to the vent pipes from jet forces.

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

2.4.1.2 *Staff Evaluation*

The staff reviewed LRA Section 2.4.1 using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4.

During its review of the LRA Section 2.4.1, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the reactor building and PC.

In RAI 2.4-1, dated July 14, 2009, the staff requested that the applicant provide additional information to confirm the inclusion or justify the exclusion of a jib crane, referenced in the USAR, located at the equipment hatch with respect to the scope of license renewal.

In its response dated August 13, 2009, and associated clarification in subsequent September 2, 2009 and September 21, 2009 teleconference summary notes, the applicant indicated that: (1) the jib crane and its associated trolley located in the reactor building are used to move CRDs when maintenance is required during an outage. The crane does not perform a safety function and it is not critical to plant operation, and it does not lift loads over safety-related equipment; (2) the crane is located so that its failure will not damage safety-related components in the reactor building; (3) the supporting base plate and anchors for the jib crane have been designed to resist seismic loads—they are included within the scope of license renewal and subject to an AMR and are addressed in the LRA Table 2.4-4 under the item "base plate," "equipment pads/foundation," and "anchor bolts;" and (4) the jib crane itself is excluded from the scope of license renewal since it does not perform a license renewal intended function in accordance with 10 CFR 54.4(a)(1), (2), or (3).

Based on its review, the staff finds the response to RAI 2.4-1 acceptable (relative to scoping and screening of SSC in accordance with 10 CFR 54) because: (1) the supporting base plate and anchors for the jib crane are within the scope of license renewal and subject to an AMR and (2) there is no potential spatial interaction between the jib crane and other safety-related components in the reactor building. The staff's concern described in RAI 2.4-1 is resolved.

In RAI 2.4-2, dated July 14, 2009, the staff requested that the applicant provide additional information to confirm the inclusion or justify the exclusion of the following components:

(a) refueling seal assembly (including refueling bellows)

(b) drywell emergency airlock

(c) drywell coating

(d) drywell shear ring

(e) drywell to reactor well bellows

(f) ring girder designed to transfer the vertical and horizontal loads of the reactor pressure vessel skirt flange to the top of the reactor pedestal

(g) torus lateral seismic restraints

(h) penetration nozzles welded to the drywell, guard pipes, flued heads, and limit stops

(i) traversing in-core probe guide tube penetrations

(j) stabilizer assembly inspection ports

(k) dryer-separator pit liner plate

(l) reactor building roof metal deck

(m) reactor building roof

(n) steam tunnel concrete roof

(o) sliding support plates

(p) spent fuel pool liner plate leak chase system

In its RAI response dated August 13, 2009, and associated clarification in subsequent September 2, 2009 and January 2010 teleconference summary notes, the applicant provided the following response for each component identified in RAI 2.4-2:

(a) The refueling bellows forms a seal between the RV and the surrounding PC drywell to permit flooding of the reactor well above the vessel. The refueling bellows is excluded from the scope of license renewal because (1) it is not part of the containment pressure boundary; (2) it is not safety-related and its failure does not adversely affect any safety function; (3) it is not required to demonstrate compliance with regulations in accordance with 10 CFR 54.4(a)(3); and (4) any leakage through the bellows is directed to a drain system inside the drywell.

(b) CNS does not have a drywell emergency airlock.

(c) Since protective coatings are not SSCs, they were not scoped in accordance with the license renewal rule and protective coating is not listed as a separate line item in LRA Table 2.4-1. Protective coatings are treated and maintained as part of the structures and components in the drywell to which they are applied. As such, coatings are within the scope of license renewal and subject to aging management review as part of drywell structures and components.

(d) The drywell shear ring is integral with the reactor concrete pedestal. It is included within the scope of license renewal and is included in the LRA Table 2.4-1 item “reactor pedestal.”

(e) The drywell to reactor well bellows provides a seal between the PC drywell and the liner of the reactor well to permit flooding of the reactor well above the vessel. It is excluded from the scope of license renewal because (1) it is not part of the containment pressure boundary; (2) it is not safety-related and its failure does not adversely affect any safety function; (3) it is not required to demonstrate compliance with regulations in accordance with 10 CFR 54.4(a)(3); and, (4) any leakage through the bellows is directed to a drain system to prevent the leakage from contacting the drywell shell.

(f) The ring girder is within the scope of license renewal and included in the LRA Table 2.4-1 item "reactor vessel support assembly."

(g) The torus lateral seismic restraints are within the scope of license renewal and included in the LRA Table 2.4-1 item "torus external supports (saddles, columns)."

(h) Penetration nozzles welded to the drywell, guard pipes, and fluid heads are within the scope of license renewal and are included in Section 2.3.2.7 of the LRA. The limit stops are considered part of the penetration assembly, are within the scope of license renewal, and are included in the LRA Table 2.4-1 item "primary containment mechanical penetrations (including those with bellows)."

(i) The PC traversing in-core probe guide tube penetrations are within the scope of license renewal and are included in the LRA Table 2.4-1 item "primary containment mechanical penetrations (including those with bellows)."

(j) The stabilizer assembly inspection ports (hatches) are within the scope of license renewal and subject to an AMR. They are included in the LRA Table 2.4-1 item "drywell equipment hatches."

(k) The dryer separator pit liner plate is integral with the reactor cavity liner and is included in the LRA Table 2.4-1 item "reactor cavity liner."

(l) The LRA Table 2.4-1 and 3.5.2-1 are revised to add a new item to include roof metal decking within the scope of license renewal and subject to an AMR.

(m)The reactor building roof structure is within the scope of license renewal and is included in the LRA Table 2.4-1 item "structural steel: beams, columns, plates."

(n) The steam tunnel concrete roof is within the scope of license renewal and is included in the LRA Table 2.4-1 item "steam tunnel."

(o) The sliding support plates are only used for torus support. They are within the scope of license renewal and are included in LRA Table 2.4-1 item "torus external supports (saddles, columns)."

(p) The spent fuel pool liner plate leak chase system is an integral attachment to the spent fuel pool liner, is within the scope of license renewal, and is included in the LRA Table 2.4-1 item "spent fuel pool liner plate."

Based on its review, the staff finds that with the exception of items (a), (b), (c), and (e), the applicant confirmed the inclusion of all components, included in RAI 2.4-2, within the scope of license renewal and subject to an AMR. The staff finds the applicant's response for items (a) acceptable because: (1) the refueling bellows is not safety-related; (2) it is not part of the containment pressure boundary; (3) its failure does not adversely affect SSCs that have an intended function in accordance with 10 CFR 54.4(a)(1); and, (4) it is not required to demonstrate compliance with regulations in accordance with 10 CFR 54.4(a)(3). The staff finds the applicant's response for item (b) acceptable because CNS does not have a drywell emergency airlock. Relative to Item (c), the applicant confirmed, in a teleconference dated January 20, 2010 that the drywell protective coating is within the scope of license renewal and subject to an AMR as part of the drywell structures and components. By letter dated March 25, 2010, the applicant supplemented its response to RAI 2.4-2(c) to clarify that the protective coating is considered within the scope of license renewal. The subject of protective coating is further discussed in RAI B.1.10-5 and evaluated in SER Section 3.0.3 ("Structure Monitoring Program" AMP).

The staff finds the applicant's response to item (e) acceptable because: the drywell to reactor well bellows is not safety-related; it is not part of the containment pressure boundary; its failure does not adversely affect any safety function; it is not required to demonstrate compliance in accordance with 10 CFR 54.4(a)(3); and any leakage through the bellows is directed to a drain system to prevent the leakage from contacting the drywell shell. The applicant also stated, in response to RAI B.1.10-1, that based on operating experience at CNS, no occurrence of leakage into the annulus air gap has been found and a vacuum test of all eight sand bed drain lines will be performed prior to the period of extended operation to ensure the lines are obstruction free.

2.4.1.3 *Conclusion*

The staff reviewed the LRA, USAR, and RAI responses to determine whether or not the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff conducted a review to determine if the applicant had failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has appropriately identified the reactor building and PC SCs within the scope of license renewal, in accordance with 10 CFR 54.4(a), and those subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.4.2 Water Control Structures

2.4.2.1 *Summary of Technical Information in the Application*

LRA Section 2.4.2 describes the water control structures, which includes the intake structure, the intake structure guide wall, and a reinforced concrete discharge structure (seal well). The purpose of the intake structure is to support and protect equipment that draws water from the Missouri River. The discharge structure has no intended functions for license renewal.

The intake structure consists of a seismic Class I reinforced concrete substructure and a seismic Class I reinforced concrete superstructure on the operating floor of the substructure. The reinforced concrete structure houses the SW pumps, fire protection pump, and associated accessories. A seismic Class II steel superstructure encloses the remainder of the operating floor, which contains the CW pumps and associated accessories.

Within the intake structure is an ice control tunnel and CW supply tunnel (i.e., intake tunnel). The ice control tunnel, which receives warm water from CW discharge, prevents build-up of ice on racks and traveling screens. The CW pumps discharge into the CW supply tunnel. Traveling screens and trash racks in the intake structure prevent debris from entering the CW and SW bays.

Pump baffle plates located in the service water bay provide separation of the service water pumps. Sluice gates isolate and control warm recirculated water that enters the ice control tunnel from the CW discharge. In addition, a sluice gate is installed between the circulating water bay and the service water bay to provide a suction path for the service water pumps if the inlet to service water bay should become clogged. This gate also provides a mechanism to allow maintenance for SW bay inlet components. The intake structure is provided with a crane for equipment maintenance.

A concrete skirt (foundation mat), plus sheet piling down to bedrock, is installed along the river face as an integral part of the bottom slab. Rip-rap is provided in front of the intake structure along the foundation mat of the forebay and along adjoining banks to supplement the skirt. The rip-rap and sheet piling provide scour protection.

The reinforced concrete superstructure provides fire protection and missile protection for the service water pumps, fire protection pump, and related accessories. Steel framing with metal roof decking encloses this concrete superstructure and the remainder of the operating floor. The steel superstructure is enclosed by metal siding, with louvers, which is designed to blow off during a tornado.

The intake structure is provided with a guide wall to reduce sediment buildup. The seismic Class II guide wall, constructed of steel sheet piling, is located in front of the intake structure and runs parallel to the intake structure. A removable gate in the guide wall provides a secondary flow path during the non-navigational season.

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

2.4.2.2 *Staff Evaluation*

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

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

In RAI 2.4-3, dated July 14, 2009, the staff requested that the applicant provide additional information to confirm the inclusion or justify the exclusion of the intake structure crane with respect to the scope of license renewal.

In its response dated August 13, 2009, and in associated clarifications in subsequent September 2, 2009 teleconference summary notes, the applicant indicated that the intake structure crane has been excluded from the scope of license renewal because (1) the intake structure crane is a nonsafety-related component, located away from safety-related SSCs when not in use; (2) when the intake structure crane is in use, there are procedural controls to prevent a load drop that could result in damage to safety-related SSCs; (3) it is not credited for mitigating a regulated event; and (4) its failure could not prevent satisfactory accomplishment of any of the functions in accordance with paragraphs (a)(1) (i), (ii), or (iii) of 10 CFR 54.4.

Based on its review, the staff finds the response to RAI 2.4-3 acceptable because the intake structure crane is a nonsafety-related component, there is no potential spatial interaction between the crane and safety-related SSCs, and it does not perform a license-renewal-intended function as defined in 10 CFR 54.4(a)(1), (2), or (3) (i.e., when in use, there are procedural controls to prevent a load drop that could result in damage to safety-related SSCs). The staff's concern described in RAI 2.4-3 is resolved.

In RAI 2.4-4, dated July 14, 2009, the staff requested that the applicant provide additional information to confirm the inclusion or justify the exclusion of the intake structure trash racks with respect to the scope of license renewal.

In its response dated August 13, 2009, and in subsequent September 2, 2009 teleconference summary notes, the applicant indicated that the intake structure trash racks are nonsafety-related components and they have been excluded from the scope of license renewal because (1) their failure would not have a cascading effect on providing adequate water supply to the service water pumps; (2) their failure could not prevent satisfactory accomplishment of any of the functions identified in paragraphs (a)(1) (i), (ii), or (iii) of 10 CFR 54.4; and (3) they do not perform a license-renewal-intended function in accordance with 10 CFR 54.4(a)(1), (2), or (3).

Based on its review, the staff finds the response to RAI 2.4-4 acceptable because the applicant clarified that the intake structure trash racks are nonsafety-related components that do not perform a license-renewal-intended function in accordance with 10 CFR 54.4(a)(1), (2), or (3). The staff's concern described in RAI 2.4-4 is resolved.

In RAI 2.4-5, dated July 14, 2009, the staff requested that the applicant provide additional information to confirm the inclusion or justify the exclusion of the intake structure gate and gate frame assembly, located near the far north end of the intake structure guide wall, with respect to the scope of license renewal.

In its response dated August 13, 2009, and in subsequent September 2, 2009 teleconference summary notes, the applicant indicated that the gate and gate frame assembly are within the scope of license renewal. The gate is a guillotine type door that slides into grooves integral to the guide wall, and is removed or set in place by a barge crane. For scoping and screening purpose, the gate's function can be compared to that of a fire damper. Its position has to be changed to perform its intended function, thus the gate is not subject to an AMR. The gate frame assembly is subject to an AMR as an integral part of the guide wall included in the LRA Table 2.4-2 item "guide wall."

Based on its review, the staff finds the response to RAI 2.4-5 acceptable because the applicant clarified that the gate frame assembly is within the scope of license renewal and subject to an AMR. The applicant also confirmed that the gate is within the scope of license renewal but it is not subject to an AMR because its function is comparable to a fire damper and its position has to be changed to perform its intended function. This is in accordance with 10 CFR 54.21(a)(1)(i). The staff's concern described in RAI 2.4-5 is resolved.

In RAI 2.4-6, dated July 14, 2009, the staff requested that the applicant provide additional information to confirm the inclusion or justify the exclusion of the sluice gate between the circulating water bay and the service water bay with respect to the scope of license renewal.

In its response to the RAI, dated August 13, 2009, the applicant stated that the sluice gate between the circulating water bay and the service water bay provides an alternate flow path in case the nonsafety-related traveling screens become clogged. The applicant also stated that the sluice gate does not perform a safety function and is excluded from the scope of license renewal since the clogged traveling screens are capable of allowing adequate flow path to the service water system without reliance on the sluice gate.

Based on its review, the staff finds the response to RAI 2.4-6 acceptable because the applicant clarified that the sluice gate does not perform a safety function and is not relied upon to provide flow path to the service water system. The staff's concern described in RAI 2.4-6 is resolved.

In RAI 2.4-7, dated July 14, 2009, the staff requested that the applicant provide additional information to confirm the inclusion or justify the exclusion of the concrete skirt, sheet piling along the river face and rip-rap in front of the intake structure with respect to the scope of license renewal.

In its response dated August 13, 2009, and in subsequent September 2, 2009 teleconference summary notes, the applicant indicated that (1) the concrete skirt and the sheet piling are integral parts of the concrete foundation; and (2) the concrete skirt is included in the item "foundation" and the sheet piling is included in the item "structural steel, beams, column, and plates" of the LRA Table 2.4-2. The applicant also stated that (1) rip-rap is placed in front of the intake structure and along the adjoining banks to supplement the skirt and sheet piling in providing scour protection. Thus, the concrete skirt and the sheet piling provide the primary scour protection; (2) rip-rap is not credited for any regulated event; and (3) rip-rap does not perform a license renewal-intended-function in accordance with 10 CFR 54.4(a)(1), (2), or (3) and it is excluded from the scope of license renewal.

Based on its review, the staff finds the response to RAI 2.4-7 acceptable because the applicant clarified that (1) the concrete skirt and the sheet piling provide the primary scour protection for the intake structure; (2) they are within the scope of license renewal and subject to an AMR; and (3) rip-rap does not perform a license-renewal-intended function in accordance with 10 CFR 54.4(a)(1), (2), or (3). The staff's concern described in RAI 2.4-7 is resolved.

2.4.2.3 *Conclusion*

The staff reviewed the LRA, USAR, and RAI responses to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined if the applicant had failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has appropriately identified the water control structures SCs within the scope of license renewal, in accordance with 10 CFR 54.4(a), and those subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

2.4.3 Turbine Building, Process Facilities, and Yard Structures

2.4.3.1 *Summary of Technical Information in the Application*

LRA Section 2.4.3 describes the turbine building, process facilities, and yard structures.

The turbine building houses the turbine-generator and associated auxiliaries. The water treatment area, machine shop, exhaust fan room, and heating boiler room, which provide support for the power supply for the Z Sump system, are located adjacent to the turbine building and are referred to as turbine building appendages. The turbine building consists of reinforced concrete exterior walls up to the operating floor. Above the turbine building operating floor and the service area appendages is an exterior wall of structural steel framing with metal siding and built-up roofing. The superstructure also supports the turbine building crane and miscellaneous monorails within the structure. Interior walls are reinforced concrete or masonry block designed to provide radiation shielding and fire protection as required to protect plant personnel and equipment. A concrete shield wall surrounds the turbine generator. The turbine pedestal is a reinforced concrete structure supported by the same foundation mat as the building. The turbine building has the intended functions in accordance with 10 CFR 54.4(a)(1), (a)(2), and (a)(3).

The ARB, control building, controlled corridor, DG building, MPF, OG filter and fan building, office building (or administration building), oil tank bunker and radwaste building are identified as process facilities and considered within the scope of license renewal.

The ARB is a reinforced concrete structure founded on compacted fill and houses the various components of the augmented radwaste system as well as the instrumentation and control systems for the augmented radwaste system. However, CNS no longer uses this system to process liquid radwaste. The interior floors are reinforced concrete supported on concrete walls and columns. The interior walls are of concrete and concrete block construction and also provide radiation shielding. The building contains no safety-related components. The building contains fire protection system water piping that is credited in the fire hazards analysis. This structure has no intended functions in accordance with 10 CFR 54.4(a)(1) or (a)(2). The structure provides shelter or protection to components credited for fire protection (10 CFR 50.48).

The control building is a reinforced concrete structure and houses instrumentation and switches required for station operation. Also located in this building are the main control room, a computer room, station batteries, RHR service water, service air, two 50,000-gallon ECSTs (located in the basement), and components of the reactor protection system. The control building has the intended functions in accordance with 10 CFR 54.4(a)(1), (a)(2), and (a)(3).

The controlled corridor is a common structure adjacent to, but separate, from the reactor building, turbine building, and control building. The controlled corridor is a reinforced concrete structure and houses the cable expansion room, through which the majority of the control, power, and instrumentation cables are routed between the cable spreading room of the control building and the reactor building. The controlled corridor has the intended functions in accordance with 10 CFR 54.4(a)(1) and (a)(3). This structure has no intended function in accordance with 10 CFR 54.4(a)(2).

The DG building is a reinforced concrete structure and houses two DGs with associated equipment including diesel day tanks, air filters, silencers, exhaust stack, and all necessary electrical equipment. An exhaust stack, located on the roof, provides an elevated release point for the exhaust gas of the DG engine. The DG building has the intended functions in accordance with 10 CFR 54.4(a)(1), (a)(2), and (a)(3).

The MPF houses fire protection equipment in accordance with 10 CFR 50.48 requirements for fire protection and other support equipment used in the maintenance and repair of plant components. A seismic isolation joint between the MPF and the control building and radwaste building prevents interaction during seismic events. The building consists of structural steel framing and concrete walls with exterior metal siding and composite roofing. The MPF is supported on piles driven into the bedrock. This structure has no intended functions in accordance with 10 CFR 54.4(a)(1) or (a)(2). The structure provides shelter or protection to components credited for fire protection (10 CFR 50.48).

The OG filter and fan building is a prefabricated metal structure that is constructed on a reinforced concrete slab on grade. This building houses the OG filter pits and the OG dilution fans and equipment supporting the Z Sump system. The OG filter and fan building has the intended functions in accordance with 10 CFR 54.4(a)(1) and (a)(2). This structure has no intended function in accordance with 10 CFR 54.4(a)(3).

The office building, also known as the administration building, is a multi-story reinforced concrete frame consisting of isolated column footings and grade beams supporting precast concrete wall panels. This building provides office facilities for station personnel and contains no safety-related components. The structure contains fire protection system water piping that is credited in the fire hazards analysis. This structure has no intended functions in accordance with 10 CFR 54.4(a)(1) or (a)(2). The structure provides shelter or protection to components credited for fire protection (10 CFR 50.48).

The oil tank bunker, located south of the machine shop, provides protection for two diesel oil storage tanks, each with its own transfer pump and piping connections to its respective fuel oil day tank. The oil tank bunker consists of a concrete slab above the tank, crushed rock fill and a concrete retaining wall. Aluminum hatch covers located above the tanks provide access to a vault above the buried tanks. The oil tank bunker has the intended functions in accordance with 10 CFR 54.4(a)(1), (a)(2), and (a)(3).

The radwaste building is a reinforced concrete structure and houses the various components of the radwaste system, as well as the control center for the radwaste system. The interior walls are of concrete and masonry block construction and also provide radiation shielding. The building contains no safety-related equipment. The building contains fire protection system water piping that is credited in the fire hazards analysis. The structure has no intended functions in accordance with 10 CFR 54.4(a)(1). The structure has the intended functions in accordance with 10 CFR 54.4(a)(2) and (a)(3) of providing shelter or protection for nonsafety-related equipment within the scope of license renewal and for components credited for fire protection (10 CFR 50.48).

The control house, 161-kilovolt (kV) switchyard, ERP tower, fire protection pumphouse, fire protection water tanks foundation, liquid nitrogen tank foundation, manholes and duct banks, transformer and switchyard support structures and foundations, transmission towers and foundations are identified as yard structures and considered within the scope of license renewal.

The control house, 161-kV switchyard, is a concrete block structure with a composite roof supported by structural steel and metal decking. This building houses a 125-volt DC battery system for control and protection power of the 161 kV breakers in the switchyard. This structure has no intended functions in accordance with 10 CFR 54.4(a)(1) or (a)(2). The structure provides shelter or protection to components credited for SBO (10 CFR 50.63).

The ERP tower, located 350 feet southeast of the reactor building, is a freestanding steel tower supporting the vent pipe (stack) which collects, mixes, and expels gaseous radioactive by-products (including the SGT discharge) from the plant in a manner which reduces on-and offsite radiation exposure. The structure is located so that the reactor containment and safety-related structures will not be damaged from a DBE. The elevated release point consists of a steel tower supported on concrete pier foundations. This structure is a self-contained prefab metal enclosure. The Z sump, an underground steel lined concrete tank located beneath the tower, must be capable of operating during design basis accident conditions to maintain secondary containment operability. The ERP tower has the intended functions in accordance with 10 CFR 54.4(a)(1) and (a)(2). This structure has no intended function in accordance with 10 CFR 54.4(a)(3).

The fire protection pumphouse houses the electric motor-driven fire pump and the diesel-driven fire pump along with the associated equipment for ensuring an adequate source of firewater is available. The structure is a reinforced concrete and concrete block wall construction with a concrete roof slab. The foundation is a reinforced concrete slab on compacted granular structural fill. This structure has no intended functions in accordance with 10 CFR 54.4(a)(1) or (a)(2). The structure provides shelter or protection to components credited for fire protection (10 CFR 50.48).

The fire water supply is stored in two 500,000 gallon capacity tanks. Each tank is supported on a reinforced concrete foundation. The foundation for fire protection water tanks has no intended functions in accordance with 10 CFR 54.4(a)(1) or (a)(2). The foundation for fire protection water tanks has intended functions in accordance with 10 CFR 54.4(a)(3) and provides support for equipment credited for fire protection (10 CFR 50.48).

The liquid nitrogen tank foundation is a reinforced concrete slab and provides structural support to the nitrogen tank to ensure its availability for safe shutdown following a fire. Nitrogen is used to inert PC and to provide instrument air loads inside PC during normal operations. After a fire, nitrogen serves as a backup to instrument air system accumulators inside PC as needed to assure proper valve operation inside PC. The structure is nonsafety-related and has no intended functions in accordance with 10 CFR 54.4(a)(1) or (a)(2). The structure has intended functions in accordance with 10 CFR 54.4(a)(3) and provides structural support of nonsafety-related structural components credited for fire protection (10 CFR 50.48).

The manholes, manhole covers, and duct banks in the CNS yard provide routing for underground cables and piping. These structures have intended functions in accordance with 10 CFR 54.4(a)(1), (a)(2), and (a)(3).

The offsite power sources required to support recovery of offsite power following an SBO are the 69 kV and 161 kV power sources. The transformers and switchyard support structures and foundations provide physical support to the startup and emergency station service transformers and the other transformer and switchyard components in the SBO offsite power recovery path. The transformer and switchyard support structures and foundations have no intended functions in accordance with 10 CFR 54.4(a)(1) or (a)(2). The 12.5 kV north switchgear and transformer, which supplies power to the electric fire pump, is required for 10 CFR 50.48. These structures have intended functions for 10 CFR 54.4(a)(3) and provide support for equipment credited or fire protection (10 CFR 50.48) and SBO (10 CFR 50.63).

The transmission towers provide physical support to the transmission lines in the SBO recovery path. The 161 kV transmission towers are of galvanized steel supported on a reinforced concrete foundation or wooden utility tower made of treated wood poles. These towers support the 161 kV lines from the 1604/1606 breakers to the station startup system transformers used for offsite power recovery. Additionally, wooden utility towers, wooden utility poles and galvanized steel structures with concrete foundations support the 69 kV line providing support for the offsite power paths. The transmission towers (and utility poles) have no intended functions for 10 CFR 54.4(a)(1) or (a)(2). The transmission towers (and utility poles) have intended functions for 10 CFR 54.4(a)(3) and provide support for equipment credited for SBO (10 CFR 50.63).

LRA Table 2.4-3 identifies the components subject to an AMR for the turbine building, process facilities, and yard structures by component type and intended function.

2.4.3.2 *Staff Evaluation*

The staff reviewed LRA Section 2.4.3 using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4.

During its review of the LRA Section 2.4.3, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the turbine building, process facilities, and yard structures.

In RAI 2.4-8, dated July 14, 2009, the staff requested that the applicant provide additional information to confirm the inclusion or justify the exclusion of the foundation piles supporting the MPF with respect to the scope of license renewal.

In its response dated August 13, 2009, the applicant stated that the foundation piles supporting the MPF are within the scope of license renewal and subject to an AMR. The applicant revised LRA Table 2.4-3 to include an item "steel piles." Also, the applicant revised LRA Table 3.5.2-3 to add information relative to aging effects on below grade steel piles.

Based on its review, the staff finds the response to RAI 2.4-8 acceptable because the applicant revised LRA Table 2.4-3 to include the steel piles within the scope of license renewal. In addition, the applicant revised LRA Table 3.5.2-3 to add information relative to aging effects on below grade steel piles. The staff's concern described in RAI 2.4-8 is resolved.

In RAI 2.4-9, dated July 14, 2009, the staff requested that the applicant provide additional information to confirm the inclusion or justify the exclusion of the turbine generator pedestal with respect to the scope of license renewal.

In its response to the RAI, dated August 13, 2009, the applicant stated that the turbine generator pedestal is within the scope of license renewal and subject to an AMR. The applicant also stated that the turbine generator pedestal is included in the LRA Table 2.4-3 item "beams, columns, floor slabs and interior walls."

Based on its review, the staff finds the response to RAI 2.4-9 acceptable because the applicant confirmed that the turbine generator pedestal is within the scope of license renewal and subject to an AMR. The staff's concern described in RAI 2.4-9 is resolved.

In RAI 2.4-10, dated July 14, 2009, the staff requested that the applicant provide additional information to confirm the inclusion or justify the exclusion of the built-up roofing system, including waterproofing membrane, with respect to the scope of license renewal.

In its response dated August 13, 2009, and in subsequent September 2, 2009 and September 21, 2009 teleconference summary notes, the applicant indicated that (1) the roofing systems, including the waterproofing membrane, are nonsafety-related components and do not perform any of the license-renewal-intended functions in accordance with 10 CFR 54.4(a)(1), (2), or (3); (2) roofing materials provide protection of equipment from the elements to protect the utility investment in equipment contained within plant structures; (3) during the operating experience review for the CNS license renewal project, several occurrences of leaking roof membrane were identified, none of which affected the operability of equipment relied on to accomplish any of the functions identified in paragraphs (a)(1) (i), (ii), or (iii) of 10 CFR 54.4; and (4) the roofing membrane is included in the scope of license renewal and is subject to an AMR. The applicant revised the LRA Table 2.4-4 and Table 3.5.2-4 to include the roofing membrane.

Based on its review, the staff finds the response to RAI 2.4-10 acceptable because the applicant revised Table 2.4-4 and Table 3.5.2-4 to include the roofing membrane in the scope of license renewal and subject to an AMR. The staff's concern described in RAI 2.4-10 is resolved.

In RAI 2.4-11, dated July 14, 2009, the staff requested that the applicant provide additional information to confirm the inclusion or justify the exclusion of the cranes and their associated subcomponents (bridge, trolley, hardware, etc.), located within the in-scope structures described in Section 2.4.3 of the LRA, with respect to the scope of license renewal.

In its response dated August 13, 2009, and in subsequent September 2, 2009 teleconference summary notes, the applicant identified that as indicated in Table 2.2-3 of the LRA, cranes, trolley, monorails and hoists are evaluated as structural components or commodities of the structure in which they are located. Accordingly, the cranes, such as turbine building crane, and their subcomponents (including bridge, trolley, hardware, rails and girders) are within the scope of license renewal and included in the LRA Table 2.4-3 item "crane rails and girders." The applicant also stated that hoists that perform their function with moving parts are not considered in the LRA Table 2.4-3 item "crane rails and girders." The associated bolting is evaluated in the LRA Section 2.4.4, "bulk commodities," and is included in the LRA Table 2.4-4 as item "structural bolting."

Based on its review, the staff finds the response to RAI 2.4-11 acceptable because (1) in accordance with the LRA Section 2.1.2.1.2, the overhead-handling systems whose failure could result in damage to a system that could prevent the accomplishment of a safety function are within the scope of license renewal in accordance with 10 CFR 54.4(a)(2); (2) the applicant confirmed that the cranes and their associated subcomponents (bridge, trolley, hardware, bolting, rails and girders) located within the in-scope structures are within the scope of license renewal and subject to an AMR. The crane hoists are considered not subject to an AMR in accordance with 10 CFR 54.4(a)(1)(i) as they perform their function with moving parts. The staff's concern described in RAI 2.4-11 is resolved.

Section 2.4.3 of the LRA describes the exhaust stack on top of the DG building roof as nonessential. Table 2.4-3 does not include the exhaust stack within the scope of license renewal. In RAI 2.4-12, dated July 14, 2009, the staff requested that the applicant provide additional information to confirm that the exhaust stack, on top of the DG building roof, does not support an intended function relative to potential spatial interaction based on the criterion defined in 10 CFR 54.4(a)(2).

In its response dated August 13, 2009, the applicant stated that the failure of the exhaust stack, on top of the DG building roof, does not support an intended function in accordance with 10 CFR 54.4(a)(2) and its failure will not adversely affect any safety function.

Based on its review, the staff finds the response to RAI 2.4-12 acceptable because the applicant confirmed that the exhaust stack, on top of the DG building, does not support an intended function in accordance with 10 CFR 54.4(a)(2). The staff's concern described in RAI 2.4-12 is resolved.

In RAI 2.4-13, dated July 14, 2009, the staff requested that the applicant provide a more detailed description of the turbine building appendages, and confirm that the entire turbine building and its appendages are within the scope of license renewal and that the components applicable to these facilities fall within the listed components in the LRA Table 2.4-3 and Table 2.4-4.

In its response dated August 13, 2009, the applicant confirmed that (1) the turbine building appendages are of similar construction as the turbine building and they are within the scope of license renewal and subject to an AMR; and (2) the structural components in the turbine building appendages are within the components listed in the LRA Table 2.4-3 and Table 2.4-4.

Based on its review, the staff finds the response to RAI 2.4-13 acceptable because the applicant confirmed that the turbine building appendages are within the scope of license renewal and subject to an AMR. The staff's concern described in RAI 2.4-13 is resolved.

Section 2.4.3 of the LRA discusses the Z sump, an underground steel lined concrete tank, located beneath the early release point tower. Table 2.4-3 of the LRA does not list this concrete tank to be within the scope of license renewal and subject to an AMR. In RAI 2.4-14, dated July 14, 2009, the staff requested that the applicant confirm the inclusion or justify the exclusion of the underground steel lined concrete tank.

In its response dated August 13, 2009, the applicant confirmed that the underground steel lined concrete tank, located beneath the early release point tower, is within the scope of license renewal and subject to an AMR. The applicant further stated that the steel liner and concrete portion of this tank is identified in LRA Table 2.4-3 items "sump liner" and "sumps," respectively.

Based on its review, the staff finds the response to RAI 2.4-14 acceptable because the applicant confirmed that the underground steel lined concrete tank, located beneath the early release point tower, is within the scope of license renewal and subject to an AMR. The staff's concern described in RAI 2.4-14 is resolved.

In RAI 2.4-15, dated July 14, 2009, the staff requested that the applicant confirm the inclusion or justify the exclusion of the shield plugs in various structures covered in Section 2.4.3.

In its response dated August 13, 2009, the applicant confirmed that the shield plugs for the turbine building, process facilities and yard structures covered in Section 2.4.3 are evaluated as bulk commodities in Section 2.4.4. The applicant also indicated that the shield plugs are listed in the LRA Table 2.4-4 "steel and other metals," item "manways, hatches, manhole covers and hatch covers."

Based on its review, the staff finds the response to RAI 2.4-15 acceptable because (1) the applicant confirmed that the shield plugs are within the scope of license renewal and subject to an AMR; and, (2) the LRA Table 2.4-4 includes item "manways, hatches, manhole covers and hatch covers" in both concrete and steel material categories covering both concrete and metal shield plugs. The staff's concern described in RAI 2.4-15 is resolved.

In RAI 2.4-16, dated July 14, 2009, the staff requested that the applicant justify the exclusion of the OWCGG building.

In its response dated August 13, 2009, and in subsequent September 2, 2009 and September 21, 2009 teleconference summary notes, the applicant confirmed that the OWCGG has been excluded from the scope of license renewal because (1) the OWCGG building is a nonsafety-related structure that contains no safety-related components; (2) failure of this building does not have any adverse effects on any functions identified in 10 CFR 54.4(a)(1)(i), (ii), or (iii); (3) the failure of this building will have no impact on adjacent structures; and (4) the OWCGG building does not perform any of the license renewal intended functions defined in 10 CFR 54.4(a)(1), (2), or (3).

Based on its review, the staff finds the response to RAI 2.4-16 acceptable because the OWCGG building is a nonsafety-related structure, it contains no safety-related components, its failure will have no impact on adjacent structures, and it does not support any of the license renewal intended functions defined in 10 CFR 54.4(a)(1), (2), or (3). The staff's concern described in RAI 2.4-16 is resolved.

2.4.3.3 *Conclusion*

The staff reviewed the LRA, USAR, and RAI responses to determine whether or not 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 if the applicant had failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has appropriately identified the turbine building, process facilities, and yard structures SCs within the scope of license renewal in accordance with 10 CFR 54.4(a), and those subject to an AMR in accordance with 10 CFR 54.21(a)(1).

2.4.4 Bulk Commodities

2.4.4.1 *Summary of Technical Information in the Application*

The LRA Section 2.4.4 describes the bulk commodities. Bulk commodities subject to an AMR are structural components or commodities that perform or support intended functions of in-scope SSCs. Bulk commodities unique to a specific structure are included in the review for that structure (Sections 2.4.1 through 2.4.3 of the LRA). Bulk commodities common to in-scope SSCs (anchors, embedments, pipe and equipment supports, instrument panels and racks, cable trays, and conduits, etc.) are addressed in this section as well as seismic II/I supports. Insulation may have the specific intended functions of (1) controlling the heat load during design basis accidents in areas with safety-related equipment, or (2) maintaining integrity so that falling insulation does not damage safety-related equipment (reflective metallic type RV insulation).

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

2.4.4.2 *Staff Evaluation*

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

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

In RAI 2.4-17, dated July 14, 2009, the staff requested that the applicant provide additional information to confirm the inclusion or justify the exclusion of (1) shielding for HELB, (2) grout pads for building structural column base plates, and, (3) fire dampers with respect to the scope of license renewal.

In its response dated August 13, 2009, and in subsequent September 2, 2009 teleconference summary notes, the applicant confirmed that (1) shielding for HELB is included within the LRA Table 2.4-4 item “missile shields;” (2) the intended function for “HELB barrier” is EN and for “missile barrier” is MB. Missile shields perform both of these functions; (3) in the LRA Table 2.4-4 and Table 3.5-4, concrete missile shields are listed only with an MB intended function while steel missile shields are listed with intended functions EN and MB. Listing the EN function for steel missile shields is appropriate since steel structures are used for HELB barriers; (4) HELB shielding applicable to the PC is included within the LRA Table 2.4-1 item “drywell shell protection panels and jet deflectors;” (5) grout pads for building structural column base plates are included within the LRA Table 2.4-4 item “equipment pads/foundations;” and (6) fire dampers are addressed in Section 2.3.3.8 of the LRA and the LRA Table 2.3.3-8 item “damper housing.”

Based on its review, the staff finds the response to RAI 2.4-17 acceptable because the applicant confirmed that (1) shielding for HELB and grout pads for building structural column base plates are within the scope of license renewal and subject to an AMR; and, (2) fire dampers have been addressed in Section 2.3.3.8.

2.4.4.3 *Conclusion*

The staff reviewed the LRA, USAR, and RAI responses to determine if 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 or not the applicant failed to identify any SCs subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that the applicant has appropriately identified the bulk commodities SCs within the scope of license renewal in accordance with 10 CFR 54.4(a), and those subject to an AMR in accordance with 10 CFR 54.21(a)(1).

2.5 Scoping and Screening Results: Electrical and Instrumentation and Controls

This section documents the staff’s review of the applicant’s scoping and screening results for EIC systems. Specifically, this section discusses: EIC component commodity groups.

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

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

In its scoping evaluation, the staff reviewed the applicable LRA sections focusing on components that have not been identified as within the scope of license renewal. The staff reviewed the USAR for each EIC system to determine whether or not the applicant has omitted from the scope of license renewal components with intended functions delineated under 10 CFR 54.4(a).

After its review of the scoping results, the staff evaluated the applicant's screening results. For those SSCs with intended functions, the staff sought to determine if (1) the functions are performed with moving parts or a change in configuration or properties or, (2) the SSCs are subject to replacement after a qualified life or specified time period in accordance with 10 CFR 54.21(a)(1). For those meeting neither of these criteria, the staff sought to confirm that these SSCs were subject to an AMR in accordance with 10 CFR 54.21(a)(1).

2.5.1 Electrical and Instrumentation and Controls Systems

2.5.1.1 *Summary of Technical Information in the Application*

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

LRA Table 2.5-1 identifies EIC systems component types and their intended functions within the scope of license renewal and subject to an AMR

- cable connections (metallic parts) – conducts electricity
- electrical cables and connections and fuse holders (insulation) not subject to 10 CFR 50.49 EQ requirements (includes non-EQ EIC penetration conductors and connections) – conducts electricity
- electrical cables not subject to 10 CFR 50.49 EQ requirements used in instrumentation circuits – conducts electricity
- fuse holders (insulation material) – conducts electricity
- high-voltage insulators (high-voltage insulators for SBO recovery) – insulation (electrical)
- inaccessible medium-voltage cables not subject to 10 CFR 50.49 EQ requirements – conducts electricity
- metal-enclosed bus (non-segregated bus for SBO recovery)/bus and connections – conducts electricity

- metal-enclosed bus (non-segregated bus for SBO recovery)/insulation/insulators – insulation (electrical)
- metal-enclosed bus (non-segregated bus for SBO recovery)/enclosure assemblies – support for Criterion(a)(3)equipment
- switchyard bus (switchyard bus for SBO recovery)/connections – conducts electricity
- transmission conductors/connections (transmission conductors for SBO recovery)/connections – conducts electricity

2.5.1.2 *Staff Evaluation*

The staff reviewed LRA Section 2.5 and USAR Sections 7 and 8 using the evaluation methodology described in 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 USAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions in accordance with 10 CFR 54.4(a). The staff finds no such omissions. The staff then reviewed those components that the applicant has identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1). The staff finds no such omissions.

The staff reviewed applicability of General Design Criteria 17 of 10 CFR Part 50, relative to scoping and screening of SSCs within the scope of license renewal in accordance with 10 CFR 54. General Design Criteria 17 of 10 CFR Part 50, Appendix A, requires that electric power from the transmission network to the onsite electric distribution system is supplied by two physically independent circuits to minimize the likelihood of their simultaneous failure. In addition, the staff noted that the guidance provided by letter dated April 1, 2002, "Staff Guidance on Scoping of Equipment Relied on to Meet the Requirements of the Station Blackout Rule (10 CFR 50.63) for License Renewal (10 CFR 54.4(a)(3))," and later incorporated in SRP-LR Section 2.5.2.1.1 states:

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

The applicant included the complete circuits between the onsite circuits, up to and including, switchyard breakers (which includes the associated controls and structures), supplying the startup station service transformer (SSST) and the emergency station service transformer

(ESST) within the scope of license renewal. The SSST and ESST supply power to both 4.16-kV safety busses. Consequently, the staff concludes that the scoping is consistent with the guidance issued April 1, 2002 and later incorporated it in SRP-LR Section 2.5.2.1.1.

2.5.1.3 *Conclusion*

The staff reviewed the LRA and the USAR to determine whether or not the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff determined whether or not the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has appropriately identified the EIC systems components within the scope of license renewal, in accordance with 10 CFR 54.4(a), and those subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

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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 Cooper Nuclear Station (CNS) by the staff of the United States Nuclear Regulatory Commission (NRC) referred to as the staff. In Appendix B of its license renewal application (LRA), Nebraska Public Power District (NPPD) referred to as the applicant, described the 40 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 Use of the Generic Aging Lessons Learned Report

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

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

The GALL Report identifies: (1) structures, systems, 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.

The staff's review was in accordance with Title 10, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," of the *Code of Federal Regulations* (10 CFR 54), and the guidance of the Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants (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 week of April 20, 2009. The onsite audits and reviews are designed to maximize efficiency of the staff's LRA review as follows: (1) the applicant can respond to questions, (2) the staff can readily evaluate the applicant's responses, and (3) the need for formal correspondence between the staff and the applicant is reduced, all of which resulted in an improvement in review efficiency. The results of this audit were documented in the report of June 15, 2009.

3.0.1 Format of the License Renewal Application

By letter dated September 24, 2008, the applicant submitted an application that follows the standard LRA format agreed to by the staff and the Nuclear Energy Institute (NEI). The staff conducted a sufficiency review for acceptance and issued the acceptance of the LRA on December 19, 2008. The organization of LRA Section 3 parallels that of SRP-LR Chapter 3. LRA Section 3 presents information from the AMR results in the following two table types:

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

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

In its Table 1s, the applicant summarized the portions of the application that it considered to be consistent with the GALL Report. In its Table 2s, the applicant identified the linkage between the scoping and screening results in LRA Section 2 and the AMRs in LRA Section 3.

3.0.1.1 Overview of Table 1s

Each Table 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 in the Gall Report has been replaced by an “Item Number” column and the “Item Number” in the GALL Report column has been replaced by a “Discussion” column. The “Item Number” column is a mean 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 the “Discussion” 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 an item in the LRA is consistent with the corresponding item in the GALL Report when the consistency may not be obvious
- discussion of how the item is different from the corresponding item in the GALL Report (e.g., an exception to a GALL Report AMP)

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

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, such as reactor coolant system (RCS), engineered safety features (ESFs), auxiliary systems, etc. For example, the ESFs group has tables specific to the core spray (CS) system, high-pressure coolant injection (HPCI) system, and residual heat removal (RHR) system. Each Table 2 consists of nine columns:

- Component Type – The first column lists LRA Section 2 component types subject to an AMR in alphabetical order.
- Intended Function – The second column identifies the license renewal intended functions, including abbreviations, where applicable, for the listed component types. Definitions and abbreviations of intended functions are in LRA Table 2.0-1.
- Material – The third column lists the particular construction material(s) for the component type.
- Environment – The fourth column lists the environments to which the component types are exposed. Internal and external service environments are indicated with a list of these environments in LRA Tables 3.0-1 and 3.0-2.
- Aging Effect Requiring Management – The fifth column lists aging effects requiring management (AERM). As part of the AMR process, the applicant determined any AERM for each combination of material and environment.
- Aging Management Programs – The sixth column lists the AMPs that the applicant uses to manage the identified aging effects.
- NUREG-1801 Volume 2 Item – The seventh column lists the GALL Report item(s) identified in the LRA as similar to the AMR results. The applicant compared each combination of component type, material, environment, AERM, and AMP in LRA Table 2 with the GALL Report items. If there are no corresponding items in the GALL Report, the applicant leaves the column blank (or N/A) in order to identify the AMR results in the LRA tables corresponding to the items in the GALL Report tables.
- Table 1 Item – The eighth column lists the corresponding summary item number from LRA Table 1. In each LRA Table 2, if the applicant identifies AMR results consistent with the GALL Report, the Table 1 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 or N/A. In this manner, the information from the two tables can be correlated.
- Notes – The ninth column lists the corresponding notes used to identify how the information in each Table 2 aligns with the information in the GALL Report. The notes, identified by letters, were developed by an NEI work group and will be used in future LRAs. Any plant-specific notes identified by

numbers provide additional information about the consistency of the item with the GALL Report.

3.0.2 Staff's Review Process

The staff conducted two types of evaluations of the AMRs and AMPs:

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

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

The SRP-LR states that an applicant may take one or more exceptions to specific GALL Report program elements; however, any deviation from, or exception to, the GALL Report should be described and justified. Therefore, the staff considers exceptions to be portions of the GALL Report that the applicant does not intend to implement.

In some cases, an applicant may choose an existing plant program that does not meet all the program elements defined in the GALL Report. However, the applicant may make a commitment to augment the existing program to satisfy the GALL Report 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 in accordance 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 functions consistent with the plant's current licensing basis (CLB) for the period of extended operation in accordance with 10 CFR Part 54.

3.0.2.1 Review of AMPs

For AMPs which the applicant claimed consistency with the GALL Report AMPs, the staff conducted 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 or not the deviation was acceptable and whether or not 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 – The 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 functions.

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

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

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

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

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

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

(10) Operating Experience – Operating experience (OE) of the AMP, including past corrective actions resulting in program enhancements or additional programs, should provide objective evidence to support the conclusion that the effects of aging will be adequately managed so that the SC intended functions will be maintained during the period of extended operation.

Details of the staff's audit evaluation of seven program elements are documented in SER Section 3.0.3. Details of the staff's audit evaluation of the remaining three program elements are documented in SER Section 3.0.4.

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

3.0.2.2 Review of AMR Results

Each LRA Table 2 contains information concerning whether or not the AMRs identified by the applicant align with the GALL Report AMRs. For a given AMR in a Table 2, the staff reviewed the intended function, material, environment, AERM, and AMP combination for a particular system component type. Item numbers in column seven of the LRA, "NUREG-1801 Volume 2 Item," correlate to an AMR combination as identified in the GALL Report. The staff also conducted onsite audits to verify these correlations. A blank or N/A 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.

The staff reviewed a given AMR in a Table 2 regarding the intended function, material, environment, and AERM and documented its evaluation in SER Sections 3.1 through 3.6. The staff documented its evaluation of the AMPs in SER Section 3.0.3.

3.0.2.3 Updated Safety Analysis Report Supplement

Consistent with the SRP-LR for AMRs and AMPs, the staff also reviewed the updated safety analysis report (USAR) supplement, which summarizes the applicant’s programs and activities for managing aging effects for the period of extended operation in accordance with 10 CFR 54.21(d).

3.0.2.4 Documentation and Documents Reviewed

In its review of the AMPs and AMRs, the staff used the LRA, LRA supplements, the SRP-LR, and the GALL Report. During the onsite audit, the staff also examined the applicant’s justifications to verify that the applicant’s activities and programs will adequately manage the effects of aging on SCs. The staff also conducted detailed discussions and interviews with the applicant’s license renewal project personnel and others with technical expertise relevant to aging management.

3.0.3 Aging Management Programs

The staff reviewed 40 of the applicant’s AMPs, as described in Appendix B of the LRA. The staff reviewed the applicant’s claim of consistency with the GALL Report AMPs and documented its review in three sections (and associated sub-sections): Section 3.0.3.1 AMPs Consistent with the GALL Report, Section 3.0.3.2 AMPs Consistent with the GALL Report with Exceptions and/or Enhancements, and Section 3.0.3.3 AMPs That Are Not Consistent with or Not Addressed in the GALL Report.

3.0.3.1 AMPs That Are Consistent with the GALL Report

3.0.3.1.1 Aboveground Steel Tanks Program

Summary of Technical Information in the Application. LRA Section B.1.1 describes the new Aboveground Steel Tanks Program as being consistent to GALL AMP XI.M29, “Aboveground Steel Tanks.” The applicant indicated that this program is credited with managing loss of material external surfaces of outdoor, and aboveground carbon steel tanks. The applicant further stated that as part of this program, periodic visual inspections of external surfaces and periodic thickness measurements of locations that are inaccessible for external visual inspection will be performed.

Staff Evaluation. During its audit and review, the staff reviewed the applicant’s claim of consistency with the GALL Report. The staff reviewed the applicant’s LRA, accompanying documentation, and the program basis document to determine whether or not the AMP is adequate to manage the aging effects for which the LRA credits it. The staff reviewed the applicant’s engineering report on AMP evaluation results for aboveground steel tanks and noted that the only outdoor carbon steel tanks that are within the scope of this program are the two fire water storage tanks. The staff confirmed that the plant program contains all of the elements of the GALL Report AMP XI.M29. The staff conducted onsite interviews with the applicant to verify the Aboveground Steel Tanks Program planning basis and planned implementation. During the audit, the staff compared the elements in the applicant's program to those in GALL AMP XI.M29. The staff confirmed the applicant's consistency with the GALL AMP XI.M33 for AMP elements 2, "preventive actions" and 10, "operating experience." In comparing the elements in the applicant's program basis document to those in GALL Report AMP XI.M29, the staff determined that additional clarification of the program basis document descriptions was required to determine the adequacy of the AMP elements 1, 3, 4, 5, and 6 for "scope of program," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria."

The applicant's LRA B1.1-1, Aboveground Steel Tanks Program, identified that it would manage loss of material by periodic inspections of external surfaces and thickness measurements of inaccessible locations. The applicant's program basis for each of these elements required clarification, as follows:

- Element 1, "scope of program," the applicant's program basis document was not clear on a commitment to, and requirements for, implementation of periodic system walkdowns adequate to manage the effects of corrosion and identify damaged coatings on the external painted surface covered with insulation. The applicant's documentation also did not address the initial determination of the condition of the external surface paint.

- Element 3, "parameters monitored/inspected," the applicant's program basis document was not clear on program requirements for inspection of external surfaces covered with insulation, periodic inspection of tank side and bottom wall thickness, and identification of the condition of the sealant applied to the interface of the tank and concrete foundation.

- Element 4, "detection of aging effects," the applicant's program basis document was not clear on program requirements for inspection of external surfaces covered with insulation, periodic inspection of the tank surfaces including the steel/concrete interface, identification of the condition of the tank surfaces and periodic measurement of the thickness.

- Element 5, "monitoring and trending," the applicant's program basis documentation was not clear on how implementation of periodic system walkdowns would be adequate to monitor and trend the effects of corrosion and identify damaged coatings on the external painted surface covered with insulation.

- Element 6, "acceptance criteria," the applicant's program basis document did not clearly identify that any degradation of the fire water storage tanks external surface paint and sealant at the steel/concrete interface will be an acceptance criterion that would be reported and would require further evaluation as stated in GALL AMP XI.M29.

The staff issued RAI B.1.1-1, dated May 1, 2009, requesting that the applicant provide additional descriptions of the basis, actions, support, and specifics for these five GALL Report AMP program elements, to include the planned inspections of the external surface of the insulated tanks, thickness measurements, and current tank feature conditions.

The applicant responded to RAI B.1.1-1 by letter dated June 15, 2009, and provided additional descriptions of the basis, actions, support, and specifics of the requested five AMP elements as follows:

- For element 1, “scope of program,” the applicant clarified that periodic walkdowns will be performed on the aboveground steel tanks and that the inspection will be acceptable, to detect insulation degradation and corrosion of tank surfaces under insulation by detection of discoloration, staining, or lagging. The applicant also stated that the most recent external and internal inspection of the aboveground tanks in September 2007, found no discoloration, degradation, or staining that would indicate degradation of the external paint or provide a pathway for moisture to reach the tank surface.

- For element 3, “parameters monitored or inspected,” the applicant indicated that its Aboveground Steel Tanks Program will include program requirements for inspection of external surfaces covered with insulation, periodic inspection of tank side and bottom wall thickness, and identification of the condition of the sealant applied to the interface of the tank and concrete foundation.

- For element 4, “detection of aging effects,” the applicant indicated that its Aboveground Steel Tanks Program will include requirements for inspection of external surfaces covered with insulation, periodic inspection of the tank surfaces including the steel/concrete interface, identification of the condition of the tank surfaces and periodic measurements of the wall thickness.

- For element 5, “monitoring and trending,” the applicant indicated the Aboveground Steel Tanks Program will require that periodic walkdowns be performed on the aboveground steel tanks and that the inspection will be acceptable and will detect insulation degradation and corrosion of tank surfaces under insulation by detection of discoloration, staining, or lagging. The applicant also indicated that the most recent external and internal inspection of the aboveground tanks in September 2007, found no discoloration, degradation, or staining that would indicate degradation of the external paint or provide a pathway for moisture to reach the tank surface.

- For element 6, “acceptance criteria,” the applicant indicated that any degradation of the fire water storage tanks external surface paint and sealant at the steel/concrete interface will be an acceptance criterion that would be reported and would require further evaluation as stated in GALL AMP XI.M29. It also stated that further evaluation would be under the plant’s corrective action program.

Based on its review, the staff finds the applicant’s response to RAI B.34-1 acceptable because it satisfactorily answers the questions posed in the RAI. Therefore, the staff’s concerns described in RAI B.1.1-1 are resolved.

Based on its review, the staff finds the Aboveground Steel Tanks Program consistent with the program elements of GALL AMP XI.M29, and therefore acceptable.

Operating Experience. The staff reviewed the limited OE provided in LRA Section B.1-1, CNS inspections of the tanks, and also interviewed the applicant's technical staff to confirm that the plant-specific OE did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific OE have been reviewed by the applicant and are to be evaluated pursuant to the GALL Report recommendation. The staff reviewed the inspection results from 2007, and noted that the applicant found that the tanks did not have significant corrosion based on an internal robotic camera inspection. The staff conducted an independent search of the applicant's condition report database for OE relevant to the Aboveground Steel Tanks Program. The search resulted in a review of 136 results through the use of keywords: "steel tank interface" and "concrete-metal." The staff screened these results, and reviewed them for relevance to the AMP in evaluating the adequacy of the applicant's OE review. The staff verified that the OE from the independent search did not indicate age-related degradation that would be applicable to this program. In the application, the applicant indicated that the program is a new program and therefore there is no OE for the effectiveness of the program.

Based on its review, the staff finds that the applicant is committed to taking appropriate corrective actions through implementation of this AMP element. The staff confirmed that the "operating experience" program element satisfies the criteria defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

USAR Supplement. The applicant's USAR supplement for the Aboveground Steel Tanks Program is found in LRA Section A.1.1.1. The staff confirmed that the applicant's USAR supplement summary description for this program conforms to the staff's recommended USAR supplement guidance found in the SRP-LR. The staff determined that the information in the USAR supplement is an acceptable summary description of the Aboveground Steel Tanks Program in accordance with 10 CFR 54.21(d).

In Commitment No. NLS2008071-01, the applicant committed to implement the Aboveground Steel Tanks Program prior to the period of extended operation. The staff confirmed that the applicant has made a commitment to implement this new program, after issuance of the renewed license and prior to entering the period of extended operation.

Conclusion. On the basis of its review of the applicant's Aboveground Steel Tanks Program, including the applicant's responses to the RAI's, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

3.0.3.1.2 Buried Piping and Tanks Inspection

Summary of Technical Information in the Application. LRA Section B.1.3 describes the new Buried Piping and Tanks Inspection Program as being consistent with GALL AMP XI.M34, "Buried Piping and Tanks Inspection." Using this program, the applicant proposes to manage the effects of corrosion in buried carbon steel, gray cast iron, and stainless steel components via a combination of external coatings and periodic inspections.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. Two instances of potential inconsistencies were observed. These issues involve the materials within the scope of the proposed program and the standards used for coating application. These issues are detailed in the paragraphs below.

Program element 1, scope of the program (GALL Report AMP), states that only buried steel piping and tanks are included in the program. The Buried Piping and Tanks Inspection Program as proposed by the applicant includes buried steel and stainless steel tanks. Both programs recommend/propose that all buried piping be wrapped or coated, or both. The staff notes that the corrosion characteristics of steel and stainless steel exposed to soil are quite different. Steel in contact with soil is in an active state. Exclusion of water and oxygen by the coating will improve corrosion performance. Stainless steel in contact with soil is in a passive state. This passive state is created by the presence of oxygen. Exclusion of oxygen by a coating may cause the stainless steel to become active and may increase its corrosion rate.

By letter dated May 1, 2009, the staff issued request for additional information (RAI) B.1.3-1 requesting that the applicant justifies the inclusion of stainless steel in this AMP or, propose an alternate program suitable for stainless steel piping and tanks.

The applicant responded by letter dated June 15, 2009, indicating that the stainless steel material which was originally believed to be buried was, in fact, above the surface of the ground. Based on this information the applicant revised appropriate sections of the LRA including the AMP. The staff finds this response acceptable because the scope of the LRA AMP is now consistent with the GALL Report AMP.

Program element 2, preventive actions of the GALL Report AMP, states that an external coating should be applied to buried piping in accordance with industry standards. The Buried Piping and Tanks Inspection Program as proposed by the applicant states only that an external coating will be applied to buried piping. The staff notes that coatings which are not applied in accordance with industry standards may or may not be effective in protecting buried piping.

By letter dated 1 May 2009, the staff issued RAI B.1.3-2 requesting that the applicant confirm that the coatings used on buried piping conform to industry standards.

The applicant responded by letter dated June 15, 2009, indicating that site specifications require that coatings and coverings be applied in accordance with the latest issue of American Water Works Association Specification C203, "Coal-Tar Protective Coatings and Linings for Steel Water Pipelines-Enamel and Tape-Hot Applied." The staff finds this response acceptable because the applicant is applying coatings for buried piping in accordance with an industry standard as recommended by the Gall Report AMP.

Based on its review, the staff finds that elements one through six of the applicant's proposed Buried Piping and Tanks Inspection Program (Commitment No. NLS20080071-03) are consistent with the corresponding program elements of GALL AMP XI.M34, and therefore acceptable.

Operating Experience. The staff reviewed the OE provided in LRA Section B.1.3, interviewed the applicant's technical personnel, and conducted an independent search of the applicant's condition report database during the audit to confirm that plant specific OE did not reveal any degradation not bounded by industry experience. Except as noted below, the staff found that the OE provided by the applicant was consistent with that identified in the staff's search. In LRA Section B.1.3, the applicant stated that, "Plant operating experience for this program will be gained as it is implemented during the period of extended operations, and will be factored into the program via the confirmation and corrective action elements of the CNS 10 CFR 50

Appendix B quality assurance program." Given that there have been a number of recent industry events involving leakage from buried or underground piping, the staff needs further information to evaluate the impact that these recent industry events might have on the applicant's Buried Piping and Tanks Inspection Program. The staff has communicated this need for further evaluation with the applicant and the issue will remain as open item OI 3.0.3.1.2-1.

In its independent review of the applicant's condition report database, the staff noted that at least some of buried piping has been cathodically protected. Based on the information contained in the condition report database, it appears to the staff that portions of the system may also have been improperly connected or operated during one or more periods of time. Such improper connection or operation of a cathodic protection system can actually aggravate rather than mitigate corrosion. Since cathodic protection of buried piping is neither recommended by the GALL Report nor credited by the CNS AMP, the staff determined that the improper use of the cathodic protection system discussed above is not a concern related to aging management for period of extended operation. However, through this discussion with the staff, the applicant acknowledged that the issue identified could have an impact to current operations, and initiated a condition report to investigate the significance of these findings.

Pending further evaluation of OI 3.0.3.1.2-1, the staff has not been able to confirm that the Buried Piping and Tanks Inspection Program is suitably informed by the recent relevant operating experience of leaks from buried piping.

Updated Safety Analysis (USAR) Supplement. The USAR supplement for the Buried Piping and Tanks Inspection AMP is provided in LRA Section A.1.1.3. The staff reviewed the USAR supplement and determined that, pending resolution of OI 3.0.3.1.2-1, the information in the USAR supplement conforms to the description of this program contained in the SRP-LR and is, therefore, an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Buried Piping and Tanks Inspection AMP, including the applicant's responses to the RAIs, the staff finds that all program elements are consistent with the GALL Report. Pending resolution of OI 3.0.3.1.2-1, 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 in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

3.0.3.1.3 Boiling-Water Reactor Control Rod Drive Return Line Nozzle Program

Summary of Technical Information in the Application. LRA Section B.1.4 describes the existing Boiling-Water Reactor (BWR) Control Rod Drive (CRD) Return Line Nozzle Program as consistent with GALL AMP XI.M6, "BWR CRD Return Line Nozzle." The applicant indicated that this program consists of enhanced inspection and system modifications and maintenance programs to mitigate cracking to assure that the aging degradation due to fatigue is adequately monitored in the CRD return line nozzle so that its intended function is maintained.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed LRA Chapter 3, Table 3.1.1 and found that in item 3.1.1-38, the applicant indicated that this program manages cracking due to cyclic loading in low-alloy steel with stainless steel cladding CRD return line nozzle exposed to reactor coolant. The staff reviewed the applicant's report CNS-RPT-07-LRD02, "CNS License Renewal Project, Aging

Management Program Evaluation Report Class 1 Mechanical, BWR CRD Return Line Nozzle," and found that the applicant complied with the inspection criteria specified in GALL AMP XI.M6. The applicant further indicated that CNS has cut and capped the CRD return line nozzle to mitigate fatigue and inservice inspection (ISI) is performed in accordance with American Society of Mechanical Engineers (ASME) Section XI. Ultrasonic testing (UT) of the nozzle inside radius section and nozzle-to-vessel weld is also performed. The applicant also conducts UT examination of the CRD return line nozzle-to-cap weld in accordance with the staff approved Boiling Water Reactor Vessel Internals Program (BWRVIP)-75-A report. The staff's review of this AMP also confirmed that the boundary conditions of the plant program were consistent with the boundary conditions described in GALL AMP XI.M6.

Based on its review, the staff finds the BWR CRD Return Line Nozzle Program consistent with the program elements of GALL AMP XI.M6 and therefore acceptable.

Operating Experience. The staff reviewed the OE provided in LRA Section B.1.4 and also interviewed the applicant's technical staff to confirm that the plant-specific and industry OE did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific OE have been reviewed by the applicant and are evaluated in the GALL Report. The applicant indicated that the CRD return line nozzle inner radius section and the nozzle-to-shell weld were ultrasonically examined during the 2005 refueling outage (RFO), and found acceptable. The applicant further stated that compliance with the inspection guidelines of BWRVIP-75-A report and ASME Code, Section XI provides assurance that the effects of aging will be effectively managed during the period of extended operation.

The staff confirmed that the "operating experience" program element satisfies the criteria defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

USAR Supplement. In LRA Section A.1.1.4, the applicant provided the USAR supplement for the BWR CRD Return Line Nozzle Program. The staff reviewed this section and found that it complies with the guidelines of the GALL Report's BWR CRD Return Line Nozzle Program. It also satisfies the guidelines of SRP-LR Table 3.1-2. The staff determines that the information in the USAR supplement is an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's BWR CRD Return Line Nozzle Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

3.0.3.1.4 Boiling-Water Reactor Penetrations Program

Summary of Technical Information in the Application. LRA Section B.1.6 describes the existing BWR Penetrations Program as consistent with GALL AMP XI.M8, "BWR Penetrations." The applicant indicated that this program includes inspection and flaw evaluation guidelines that are consistent with the guidelines addressed in the BWRVIP-27-A, "BWRVIP Standby Liquid Control System/Core Spray/ Core Plate ΔP Inspection and Flaw Evaluation Guidelines," and BWRVIP-49-A," Instrument Penetration Inspection and Flaw Evaluation Guidelines," reports. The applicant further indicated that water chemistry guidelines per BWRVIP-130, "Water Chemistry," report will be complied with to ensure the integrity of the penetrations.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff noted that the applicant's program relies on monitoring and control of reactor water chemistry based on the guidance of BWRVIP-130 Electric Power Research Institute (EPRI)-008192, which is a later revision to BWRVIP-29 recommended in the GALL Report, and is acceptable because the GALL Report recommends that the use of a later revision is acceptable. The staff reviewed LRA Chapter 3, Table 3.1.1 and found that in item 3.1.1-40, the applicant indicated that this program manages cracking due to stress-corrosion cracking (SCC) in stainless steel and nickel alloy penetrations for CRD stub tubes instrumentation. The staff reviewed the applicant's report CNS-RPT-07-LRD02, "CNS License Renewal Project, Aging Management Program Evaluation Report Class 1 Mechanical, BWR Penetrations," and noted that the inspections conducted by the applicant thus far on penetration welds complied with the applicable BWRVIP inspection guidelines. The staff's review of the applicant's BWR Penetrations Program also confirmed that the boundary conditions of the plant program were consistent with the boundary conditions described in GALL AMP XI.M8.

Based on its review, the staff finds that the applicant's BWR Penetrations Program is consistent with the GALL Report AMP and, therefore, is acceptable.

Operating Experience. The staff reviewed the OE provided in LRA Section B.1.6 and also interviewed the applicant's technical staff to confirm that the plant-specific and industry OE did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific OE have been reviewed by the applicant and are evaluated in the GALL Report. The applicant indicated that it examined instrumentation nozzle-to-safe end welds (i.e., N10, N11A/B, N12A/B and N16A/B) and found them acceptable during pressure testing during the 2005 RFO. The applicant further indicated that compliance with the inspection guidelines per the BWRVIP-27-A and BWRVIP-49-A reports and the ASME Code Section XI provides assurance in effectively managing aging effects during the period of extended operation. However, recent industry experience of cracking of the CRD return line cap weld (Inconel 182) due to intergranular stress-corrosion cracking (IGSCC) at Pilgrim Nuclear Power indicated greater susceptibility of the Inconel 182 weld to SCC compared to the stainless steel welds. Therefore, the inspection criteria for Inconel 182 welds will be different than those for stainless steel welds. GALL AMP XI.M8 provides the same inspection guidelines for Inconel 182 welds and stainless steel welds. Consequently, in RAI B.1.6-01 dated May 1, 2009, the staff requested that the applicant identify where Inconel 182 welds exposed to RCS water are used in the BWR vessel penetrations, and describe how the aging effects on the intended functions of penetrations will be managed during the period of extended operation.

In a letter dated June 15, 2009, the applicant stated that Inconel 182 weld metal was used in six instrument line safe-end welds at N11A/B, N12A/B, and N16A/B. The applicant indicated that consistent with the BWRVIP-49-A and the ASME Code, Section XI inspection requirements, these instrumentation nozzles are inspected using the visual testing (VT)-2 method after every outage. Nozzles N16A/B are volumetrically examined every 10 years. The CRD return line cap welds are examined per the staff approved BWRVIP-75 report. Since the applicant complied with the inspection requirements of the ASME Code, Section XI, BWRVIP-49-A and BWRVIP-75-A, the staff accepts the applicant's response. Therefore, the staff considers that concerns related to RAI B.1.6-01 are resolved.

Based on its review, including the applicant's response to the RAI, the staff confirmed that the "operating experience" program element satisfies the criteria defined in the GALL Report and in the SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

USAR Supplement. In LRA Section A.1.1.6, the applicant provided the USAR supplement for the BWR Penetrations Program. The staff reviewed this section and found that it complies with the guidelines of the GALL BWR Penetrations Program. The USAR supplement also satisfies the guidelines of the SRP-LR, Table 3.1-2. The staff determines that the information in the USAR supplement is an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's BWR Penetrations Program, and the applicant's responses to the RAIs, the staff finds that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

3.0.3.1.5 Boiling-Water Reactor Vessel Inside Diameter Attachment Welds Program

Summary of Technical Information in the Application. LRA Section B.1.8 describes the existing BWR Vessel ID Attachment Welds Program as consistent with the GALL Report AMP XI.M4, "BWR Vessel ID Attachment Welds." The applicant indicated that this program entails (a) inspection and evaluation in accordance with the guidelines of the staff-approved BWRVIP-48-A report, "BWR Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines," and (b) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of the BWRVIP-130 report, "Water Chemistry," to ensure the long-term integrity and safe operation of reactor pressure vessel (RPV) ID attachment welds and support pads.

Regarding OE, the applicant indicated that during the previous RFOs it examined guide rod brackets, FW sparger brackets, jet pump riser brace attachment pad welds, steam dryer support brackets, and holddown brackets for surveillance specimens and the steam dryer, and found them acceptable per the inspection criteria specified in the applicable BWRVIP reports. The CS sparger brackets were also examined in accordance with the BWRVIP-48-A report and the indications were evaluated and accepted per the acceptance criteria specified in the

BWRVIP-48-A report. The applicant further stated that compliance with the inspection guidelines per the BWRVIP-48-A report and the ASME Code, Section XI, provides assurance that the effects of aging will be effectively managed such that the BWR vessel ID attachment welds will continue to perform their intended functions during the period of extended operation.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff noted that the applicant's program relies on monitoring and control of reactor water chemistry based on the guidance of the BWRVIP-130 report (EPRI-008192), which is a later revision to the BWRVIP-29 report, "BWR Water Chemistry Guidelines," recommended in the GALL Report, and is acceptable because the GALL Report recommends that the use of a later revision is acceptable. The staff reviewed LRA Chapter 3, Table 3.1.1 and found that in line item 3.1.1-42, the applicant indicated that this program manages cracking due to SCC in stainless steel and nickel alloy vessel ID attachment welds exposed to reactor coolant. The staff found this to be consistent with the GALL Report. The staff's review of the BWR Vessel ID Attachment Welds Program also confirmed that the boundary conditions of the plant program were enveloped by the boundary conditions described in GALL Report AMP XI.M4.

The staff also reviewed the OE described in LRA Section B.1.8. However, industry experience indicated that cracking due to IGSCC was discovered in the CRD return line cap weld (Inconel 182) at Pilgrim Nuclear Power Station. Inconel 182 welds are more susceptible to IGSCC than stainless steel welds. GALL Report AMP XI.M4 provides the same inspection guidelines for Inconel 182 welds and stainless steel welds. Consequently, in RAI B.1.8-1 dated, May 1, 2009, the staff requested that the applicant identify where Inconel 182 welds exposed to RCS water are used in the BWR vessel ID attachment welds, and describe how the aging effects on the intended functions of vessel ID attachment welds will be managed during the period of extended operation.

In a letter dated June 15, 2009, the applicant indicated that Inconel 182 and stainless steel weld materials were used for the attachment welds. The inspection requirements specified in BWRVIP-48-A and the ASME Code, Section XI Item B13.20 (attachment welds within the beltline), Item B.13.30 (attachment welds outside beltline) and, Item B13.40 (core support structures) were used to monitor the aging degradation in the attachment welds. In addition, the applicant indicated that it complied with the water chemistry program guidelines in the BWRVIP-130 report. The staff reviewed and accepts this response based on the following: (1) inspection requirements per the ASME Code, Section XI and BWRVIP-48-A report would effectively identify any aging degradation in a timely manner; (2) inspections performed thus far, have shown indications in some welds which were accepted per the applicable BWRVIP inspection criteria; (3) effective control of water chemistry with HWC in conjunction with NMCA does mitigate IGSCC in welds where protection due to HWC and NMCA is expected; (4) the applicant's continuous compliance with the BWRVIP programs and the ASME Code, Section XI requirements would effectively monitor the aging degradation in RPV ID attachment welds during the period of extended operation. Therefore, the staff considers that its concern related to RAI B.1.8-1 is resolved.

Based on the staff's review, including the applicant's response to the RAI, the staff confirmed that the "operating experience" program element satisfies the criteria defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

USAR Supplement. In LRA Section A.1.1.8, the applicant provided the USAR supplement for the BWRV ID Attachment Welds Program. The staff reviewed this section and found that it complies with the guidelines of the GALL BWRV ID Attachment Welds Program. The USAR supplement also satisfies the guidelines of SRP-LR Table 3.1-2. The staff determines that the information in the USAR supplement is an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's BWRV ID Attachment Welds Program, including the applicant's response, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

3.0.3.1.6 Environmental Qualification of Electric Components Program

Summary of Technical Information in the Application. LRA Section B.1.13 describes the existing Environmental Qualification (EQ) of Electric Components Program as consistent with GALL AMP X.E1, "Environmental Qualification (EQ) of Electric Components." The applicant indicates that the EQ Program manages the effects of thermal, radiation, and cyclic aging through the use of aging evaluations in accordance with 10 CFR 50.49(f) qualification methods. The applicant also indicates that in accordance with 10 CFR 50.49, EQ components are refurbished, replaced, or their qualification extended, prior to reaching the aging limits established in the evaluation. Aging evaluations for EQ components are time-limited aging analyses (TLAAs) for license renewal.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. LRA Section B.1.13 states that the EQ of Electric Components Program is consistent with GALL AMP X.E1. The staff also confirmed that the plant program contains all of the elements of the referenced GALL Report and that the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated.

The staff verified that the program elements contained in the EQ of Electric Components Program are consistent with the GALL AMP X.E1 program elements except for program element "acceptance criteria." The GALL AMP X.E1 program element "acceptance criteria" states, in part, that in accordance with 10 CFR 50.49, an inservice EQ component be maintained within the bounds of its qualification basis, including (a) its established qualified life, and (b) continued qualification for projected accident conditions. The EQ of Electric Components Program does not specify as part of the acceptance criteria program element, that the EQ component qualification basis includes "(b) continued qualification for the projected accident conditions." In RAI B.1.13-1 dated May 1, 2009, the staff requested that the applicant provide justification for the missing acceptance criteria or revise the EQ of Electric Components Program to include the missing information under the "Acceptance Criteria" program element. In its response dated June 15, 2009 the applicant indicated that CNS LRA Section B.1.13 for NUREG-1801 Consistency states, "The Environmental Qualification (EQ) of Electric Components Program is consistent with the program described in NUREG-1801, Section X.E1, Environmental Qualification (EQ) of Electric Components." The applicant also indicated that LRA Section B.1.13 takes no exceptions to NUREG-1801, Section X.E1. Further, the applicant indicated that the CNS B.1.13 program is fully consistent with the acceptance criteria of NUREG-1801, Section X.E1, including the phrase "continued qualification for the projected accident conditions." However, the staff was concerned that the applicant did not indicate whether or not the EQ of Electric Components Program acceptance criteria program element would also be revised consistent with GALL AMP X.E1. By conference call held October 5, 2009, the applicant clarified its RAI response to show that the EQ of Electric Components

Program acceptance criteria will be revised consistent with GALL AMP X.E1. Based on the above, the staff finds the applicant's RAI response acceptable because the EQ of Electric Components Program is now consistent with GALL AMP X.E1 with no exceptions, and is consistent with the acceptance criteria of GALL AMP X.E1 including continued EQ component qualification for the projected accident conditions in accordance with 10 CFR 50.49 requirements. Compliance with 10 CFR 50.49 provides reasonable assurance that components can perform their intended functions during accident conditions after experiencing the effects of inservice aging. The staff's concerns described in RAI B.1.13-1 are resolved. Based on its review, the staff finds the applicant's EQ of Electric Components Program consistent with the program elements of GALL AMP X.E1, and therefore acceptable.

Operating Experience. The staff reviewed the OE described in LRA Section B.1.13. The applicant indicated that the EQ Program is routinely audited to ensure that program elements are carried out properly. The applicant summarized the results of a 2004 quality assurance (QA) program audit indicating that the translation of design criteria into working documents including the establishment of design basis accident (DBA) margins, station EQ parameters, the use of EQ data packages to establish qualified life for components, EQ maintenance tasks, and modifications activities involving EQ components were found to be conducted in accordance with station process and procedures. The applicant also indicated that no exceptions or deviations from approved codes and standards were observed during a review of EQ design and licensing documents. The applicant further stated that corrective actions taken to prevent recurrence of significant conditions were found to be effective, based on a review of significant condition reports related to the EQ Program.

The staff audited the OE described in the applicant's basis document, including a sample of condition reports prepared by the applicant, and interviewed the applicant's technical staff to confirm that the plant-specific OE did not reveal any degradation not bounded by industry experience. The staff review noted that the sample condition reports were limited and did not clearly differentiate between condition reports as relating to EQ. In addition, specific EQ OE was not referenced in LRA Section B.1.13 including references and discussion of the Environmental Qualification Improvement Project (EQIP).

In RAI B.1.13-2 dated May 1, 2009, the staff requested that the applicant provide recent representative OE and a summary description of the EQIP relevant to LRA Section B.1.13 OE. In its response dated June 15, 2009, the applicant provided additional information on the EQIP. The applicant indicated that the EQIP is complete with the first phase restoring compliance in accordance with 10 CFR 50.49. The applicant also indicated that subsequent to completion of the EQIP, the staff performed a compliance audit in accordance with 10 CFR 50.49, from the 6th through the 10th of October 2003, and no findings or recommendations were reported. The applicant further indicated that a 2007 quarterly health report denoted that program infrastructure, implementation, and monitoring were acceptable. Based on its review, the staff finds the RAI response acceptable because the applicant provided additional clarification and details concerning the EQIP and subsequent plant audits. The "operating experience" program element is consistent with that in GALL AMP X.E1 and demonstrates that identification of program weaknesses and corrective actions as part of the EQ Program provides assurance that the program will remain effective in assuring that equipment is maintained within its qualification basis and qualified life. The staff's concerns described in RAI B.1.13-2 are resolved.

To further evaluate OE, the staff performed a supplemental search and review of the applicant's condition reports and interviewed the applicant's technical staff to confirm that the plant-specific experience did not reveal any degradation not bounded by industry experience.

The staff confirmed that the "operating experience" program element satisfies the criteria defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

USAR Supplement. In LRA Appendix A, Section A.1.1.13 the applicant provided the USAR supplement for the EQ of Electric Components. The staff reviewed the USAR supplement and noted that it did not include reanalysis attributes consistent with the program description of LRA Section B.1.13 and SRP-LR Table 4.4.2. GALL AMP X.E1 states that reanalysis of an aging evaluation is normally performed to extend the qualification by reducing excess conservatism incorporated in the prior evaluation. 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).

In RAI B.1.13-3 dated June 29, 2009, the staff requested that the applicant provide justification for not including the reanalysis attributes in the USAR supplement. In its response dated July 29, 2009, the applicant stated that based on a review of the guidance in NUREG-1800, the NPPD concurs that a clarification is appropriate for LRA Section A.1.1.13. The applicant further indicated that the LRA is amended to discuss reanalysis attributes in CNS LRA Section A.1.1.13. Based on its review, the staff finds the RAI response acceptable because the applicant revised LRA Section A.1.1.13 to be consistent with SRP-LR Table 4.4.2. The staff's concern described in RAI B.1.13-1 is resolved.

The staff determined that the information in the USAR supplement, as revised by the applicant, is an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's EQ of Electric Components Program and the applicant's responses to RAIs B.1.13-1, 2, and 3, the staff finds all program elements consistent with GALL AMP X.E1. 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 in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

3.0.3.1.7 Non-Environmental Qualification Inaccessible Medium-Voltage Cable Aging Management Program

Summary of Technical Information in the Application. LRA Section B.1.25 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." The applicant indicated that this AMP will inspect for water collection in cable manholes at least once every two years and test cables exposed to significant moisture and voltage at least once every 10 years to provide an indication of the condition of the conductor insulation.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed and compared program elements of the AMP: "scope of program," "preventative actions," "parameters monitored/detected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "operating experience," to the corresponding program element criteria in GALL AMP XI.E3, "Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." The staff also confirmed that the plant program contains all of the elements of the referenced GALL Report and that the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated. The staff conducted onsite interviews with the applicant to confirm these results.

The staff's review of the "corrective actions," "administrative controls," and "confirmatory controls" program elements for the new Non-EQ Inaccessible Medium-Voltage Cable Program was performed as part of the staff's review of the QA attributes of the AMPs and is discussed in SER Section 3.0.4.

The staff compared the program's elements in the applicant's program to those in GALL AMP XI.E3. The staff noted that the program elements which the applicant claimed to be consistent with GALL AMP XI.E3 are consistent with the GALL Report. Based on its review, the staff finds the Non-EQ Inaccessible Medium-Voltage Cable Program consistent with the program elements of GALL AMP XI.E3, and therefore acceptable.

Operating Experience. The staff also reviewed the OE described in LRA Section B.1.25. In reviewing the OE for CNS, the staff noted that a manhole inspection was performed by the applicant in preparation for the license renewal aging management audit. This inspection found significant water in the following manholes: MH7, MH8, and MH9. MH5 was not inspected since it is inside the main power transformer yard; however, since it is part of the same duct it is likely there is water inside that manhole as well. In a letter dated May 11, 2009, the staff issued RAI B.1.25-1 requesting that the applicant explain how this OE and the planned corrective actions will be used to enhance the Non-EQ Inaccessible Medium-Voltage Cables and Connections Program to meet the assumption that minimizing exposure to moisture minimizes the potential for the development of water treeing before the operating unit enters the period of extended operation. In a letter dated June 15, 2009, the applicant responded to RAI B.1.25-1, indicating that manholes with electric cables would be resolved under the corrective action program. This resolution would address the need for further analysis of the condition or the need to change the dewatering or inspection frequency, so the program continues to manage the effects of aging.

The applicant also indicated that the inaccessible medium-voltage cables routed in manholes MH5, MH7, MH8, and MH9 between the 4.16-kilovolt (kV) nonsafety buses (1A and 1B) and the 161-kV control house power transformers (located in the 345-kV switchyard) were conservatively included in the scope of license renewal. These cables were listed in the scope of the Inaccessible Medium-Voltage Cable Program in LRA Section B.1.25. During a loss of offsite power (LOOP) or a station blackout (SBO), the plant breakers that feed these cables are opened. Therefore, these cables are de-energized during a LOOP or SBO. Since these cables are de-energized, they do not perform a license renewal intended function during recovery.

The applicant further explained that as stated in USAR supplement Section VIII-2.2.5: "Control and Protection," power for the 161-kV breakers is supplied by a 125-volt DC battery system in the 161-kV switchyard control house. Each 161-kV breaker is equipped with two independent trip coils fed from one power source. During normal and abnormal operation, the 161-kV switchyard breakers are controlled by the 125-volt DC systems in the 161-kV switchyard control house. Therefore, the applicant concluded that the inaccessible medium-voltage cables routed in manholes MH5, MH7, MH8, MH9 between the 4.16-kV nonsafety buses (1A and 1B) and the 161-kV control house power transformers (located in the 345-kV switchyard) are not within the scope of license renewal in accordance with 10 CFR 54.4.

The staff reviewed the applicant's response and held a conference call on October 1, 2009, to follow up on this response. After further discussion with the applicant, the staff agreed with the applicant that since the inaccessible medium-voltage cables routed in manholes MH5, MH7, MH8, MH9 between the 4.16-kV nonsafety buses (1A and 1B) and the 161-kV control house power transformers are not required during a LOOP or an SBO event, these cables are not required for the purpose of license renewal. The staff finds that the inaccessible medium voltage cables in manholes MH5, MH7, MH8, and MH9 are not in-scope of LRA Section B.1.25. The staff concludes that RAI B.1.25-1 is no longer applicable.

The staff also conducted an independent search of the applicant's condition report (CR) database for OE. The staff noted that CNS installed three sump pumps. The manholes in which the sump pumps are contained serve as collective drains for other manholes nearby. The staff reviewed a condition report which documented an HI-HI alarm in the control room generated from a failure to start by sump pump W. The condition report indicated that an operator was sent to run the sump pump manually until the alarm cleared. The pump was subsequently observed to start as expected and the alarm was cleared. The staff determined that the CR demonstrated that the applicant had implemented appropriate corrective actions.

The staff also verified that the aging effects are bounded by those identified in the GALL Report AMP XI.E3. Therefore, the staff determined that the applicant has acceptably addressed this element. The staff confirmed that the "operating experience" program element satisfies the criteria defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

USAR Supplement. In LRA Section A.1.1.25, the applicant provided the USAR supplement for the Non-EQ Inaccessible Medium-Voltage Cable Program. The staff reviewed this section and determines that the information in the USAR supplement is an acceptable summary description of the program, in accordance with 10 CFR 54.21(d). The staff also determined that the applicant's USAR supplement for this AMP is consistent with SRP-LR Table 3.6.

The applicant committed to implement this AMP prior to the period of extended operation and identified it as LRA Commitment No. NLS2008071-16.

Conclusion. On the basis of its review of the applicant's Non-EQ Inaccessible Medium-Voltage Cable Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21(a)(3).

3.0.3.1.8 Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program

Summary of Technical Information in the Application. LRA Section B.1.26 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 applicant indicated that this AMP will ensure that the intended functions of sensitive, high-voltage/low-signal cables exposed to adverse localized equipment environments (caused by heat, radiation, and moisture) can be maintained consistent with the CLB through the period of extended operation. The applicant also indicated that the review of calibration results will be performed once every 10 years, with the first review occurring before the period of extended operation.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed and compared the following program elements of the AMP: "scope of program," "preventative actions," "parameters monitored/detected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "operating experience" to the corresponding program element criteria in GALL AMP XI.E2, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits."

The staff's review of the "corrective actions," "administrative controls," and "confirmatory controls" program elements for the new Non-EQ Instrumentation Circuits Test Review AMP was performed as part of the staff's review of the QA attributes of the AMPs and is discussed in SER Section 3.0.4.

The staff compared the program elements in the applicant's program to those in GALL AMP XI.E2. The staff noted that the program elements which the applicant claimed to be consistent with the GALL Report were consistent with the corresponding program element in GALL AMP XI.E2. The staff also confirmed that the plant program contains all of the elements of the referenced GALL Report and that the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated. The staff conducted onsite interviews with the applicant to confirm these results.

Based on its review, the staff finds the Non-EQ Instrumentation Circuits Test Review Program consistent with the program elements of GALL AMP XI.E2, and therefore acceptable.

Operating Experience. The staff conducted an independent search of the applicant's condition report database for OE. The staff reviewed Condition Report (CR)-CNS-2006-02880, which states that the outer jacket for cable CR220 is cracked at a bend in the cable where the cable connects to PC penetration box X104, 903 Reactor SE above traversing incore probe room. The insulation on the internal wires is satisfactory. Subsequently; a cosmetic repair was performed in accordance with accepted practice. The staff verified that the OE described in the applicant's basis document adequately addresses the plant-specific OE for this AMP because it demonstrates the use of appropriate corrective action.

The staff confirmed that the "operating experience" program element satisfies the criteria defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

USAR Supplement. In LRA Section A.1.1.26, the applicant provided the USAR supplement for the "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program." The staff reviewed this section and determined that the information in the USAR supplement is an acceptable summary description of the program in accordance with 10 CFR 54.21(d). The staff also determined that the applicant's USAR supplement for this AMP is consistent with SRP-LR Table 3.6.

The applicant committed to implement this AMP prior to the period of extended operation and identified it as LRA Commitment No. NLS2008071-17

Conclusion. On the basis of its review of the applicant's "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program," the staff finds that all program elements are consistent with the GALL Report. The staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21(a)(3).

3.0.3.1.9 Non-Environmental Qualification Insulated Cables and Connections Program

Summary of Technical Information in the Application. LRA Section B.1.27 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 CFR50.49 Environmental Qualification Requirements." The applicant indicated that this AMP will assure the intended functions of insulated cables and connections exposed to adverse localized environments caused by heat, radiation, and moisture can be maintained consistent with the CLB through the period of extended operation. The applicant also indicated that a representative sample of accessible insulated cables and connections within the scope of license renewal will be visually inspected for cable and connection jacket surface anomalies such as, embrittlement, discoloration, cracking, or surface contamination.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed and compared the following program elements of the AMP: "scope of program," "preventative actions," "parameters monitored/detected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "operating experience" to the corresponding program element criteria in GALL AMP XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR50.49 Environmental Qualification Requirements."

The staff's review of the "corrective actions," "administrative controls," and "confirmatory controls" program elements for the new Non-EQ Insulated Cables and Connections Program was performed as part of the staff's review of the QA attributes of the AMPs and is discussed in SER Section 3.0.4.

The staff compared the program elements in the applicant's program to those in GALL AMP XI.E1. The staff noted that the program elements which the applicant claimed to be consistent with the GALL Report were consistent with the corresponding program element in the GALL AMP XI.E1. The staff also confirmed that the plant program contains all of the elements of the referenced GALL Report and that the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated. The staff conducted onsite interviews with the applicant to confirm these results.

Based on its review, the staff finds the Non-EQ Insulated Cables and Connections Program consistent with the program elements of GALL AMP XI.E1, and therefore acceptable.

Operating Experience. The staff conducted an independent search of the applicant's CR database for OE. The staff reviewed these CRs as part of its on-site review of the AMP. The staff audited the OE reports, including a sample of condition reports, and interviewed the applicant's technical staff to confirm that the plant-specific OE did not reveal any degradation not bounded by industry experience. The staff noted a condition report that described two 4-kV cables with visibly cracked insulation. The method of discovery was by a planned maintenance performed by electricians. The applicant subsequently replaced the cables; they were restored back to service. The staff noted that proper corrective actions taken in this CR were demonstrated. The staff determined that the CRs demonstrated that the applicant appropriately identified OE issues and implemented appropriate corrective actions.

The staff confirmed that the "operating experience" program element satisfies the criteria defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

USAR Supplement. In LRA Section A.1.1.27, the applicant provided the USAR supplement for the Non-EQ Insulated Cables and Connections Program. The staff noted that the applicant did not provide the frequency of inspection in the USAR Supplement. In a letter dated May 11, 2009, the staff issued RAI B.1.27-1 and requested that the applicant provide the inspection frequency for the Non-EQ Insulated Cables and Connections Program in the USAR supplement.

In a letter dated June 15, 2009, the applicant responded to RAI B.1.27-1 by adding the following wording to the USAR supplement: “to visually inspect accessible cables in an adverse localized environment at least once every 10 years, with the first inspection prior to the period of extended operation.” The staff reviewed this section and determined that the information in the revised USAR supplement in the response to RAI B.1.27-1 is an adequate summary description of the program, in accordance with 10 CFR 54.21(d). The staff also determined that the applicant’s USAR revised supplement for this AMP is consistent with SRP-LR Table 3.6.

The applicant committed to implement this AMP prior to the period of extended operation and identified it as LRA Commitment No. NLS2008071-18.

Conclusion. On the basis of its review of the applicant’s Non-EQ Insulated Cables and Connections AMP, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the revised USAR supplement in the response to RAI B.1.27-1 and concluded that it provides an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

3.0.3.1.10 One-Time Inspection Program

Summary of Technical Information in the Application. LRA Section B.1.29 describes the applicant’s proposed new One-Time Inspection Program (Commitment No. NLS2009071-20) as being consistent to GALL AMP XI.M32, “One-Time Inspection”.

The applicant indicated that this program will verify the effectiveness of an AMP and also confirm the insignificance of an aging effect. The applicant further indicated that the One-Time Inspection Program is needed to address the concerns of long incubation periods for certain aging effects and to confirm the aging effect is either not occurring or occurring very slowly as to not affect the intended function of the component or structure. Furthermore, the inspections will be nondestructive examinations (NDEs) that will be performed within 10 years prior to the period of extended operation.

The applicant further indicated that this program will be implemented to verify the effectiveness of the “Diesel Fuel Monitoring,” “Oil Analysis,” and “Water Chemistry Control” programs. It will also confirm the insignificance of aging effects in cast austenitic stainless steel (CASS) flow elements in MS and reactor recirculation (RR) lines, and internal surfaces of stainless steel components in standby gas treatment (SGT), off-gas (OG), and radwaste systems containing drain water, or circulating water (CW) systems containing river water, or service air (SA) systems exposed to condensate.

LRA Section B.1.29 states a representative sample will be chosen from each unique material and environment combination and the sample size will be based on Chapter 4 of EPRI-107514, “Age Related Degradation Inspection Method and Demonstration”.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report.

In comparing the elements in the applicant's program to those in GALL AMP XI.M32, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the exception of the "detection of aging effects" program element for which the staff required additional information as discussed below.

The staff noted that the applicant referenced, in its program description and the "detection of aging effects" program element, Chapter 4 of EPRI-107514 "Age Related Degradation Inspection Method and Demonstration." The staff noted that this document describes a method to determine the number of inspections required for 90 percent confidence that 90 percent of the population does not experience degradation (90/90). The staff also noted that the applicant did not justify the use of the 90/90 methodology and the LRA Section B.1.29 was not clear about how the locations of this representative sample will be chosen. Therefore in RAI B.1.29-1, dated May 1, 2009, the staff requested that the applicant justify the basis for using Chapter 4 of EPRI-107514 to determine the sample size of inspections for each unique material and environment combination, and clarify what is meant by "representative sample" and how the inspection locations of this representative sample will be chosen. Furthermore, the staff requested that the applicant clarifies the statement, "Components with the same material-environment combinations at other facilities may be included in the sample," and justify the use of this information in CNS's sample. By letter dated June 15, 2009, the applicant responded to the staff's RAI and indicated this document describes a method used to inspect for age-related degradation during the period of extended operation. The staff noted that the applicant's representative sample will consider each group of components with the same material-environment combination as a separate population, in which inspection locations are determined based on susceptibility (where possible low flow areas, drains, and low points will be inspected), accessibility, dose considerations, and OE. The staff further noted that all plausible aging effects for a material-environment combination will be inspected.

Furthermore, the applicant indicated that:

(1) this method describes a mean to obtain a sample size, in which it is expected that the inspections will confirm the insignificance of an aging effect

(2) this method provides for increasing the sample size if a single item in the sample population identifies significant age-related degradation

(3) the inspection locations will focus on areas that are most susceptible

The staff notes that GALL AMP XI.M32, in the elements "detection of aging effects" and "monitoring and trending" states that the inspection includes a representative sample of the system population, and, where practical, focuses on the components most susceptible to aging. The program provides for increasing the inspection sample size and locations in the event that aging effects are detected. Determining the sample size will be based on an assessment of materials of fabrication, environment, plausible aging effects, and OE. The staff finds the applicant's response to the RAI acceptable because the applicant's methodology, (1) provides for selection of a representative sample based on separate populations of material-environment combinations, (2) provides that inspection locations will be chosen based on susceptibility, accessibility, dose considerations, and OE, and (3) provides for increasing the sample size if a single item in the sample population contains significant age-related degradation, all of which are consistent with the recommendations of GALL AMP XI.M32.

The applicant also indicated that the intent of the following statement, “Components with the same material-environment combinations at other facilities may be included in the sample” is that the material-environment combinations at the applicant’s site will be similar, if not identical, to those at other BWR facilities. At other BWR facilities, the same industry guidelines are used for water chemistry control, oil analysis, and diesel fuel monitoring programs for which the One-Time Inspection Program verifies the effectiveness. The staff notes that the applicant’s intent was not to utilize inspection results from other facilities but rather utilize OE. The applicant clarified that inspections will be performed only on components at CNS. The staff notes that the applicant amended its LRA to remove this statement from LRA Section B.1.29 to avoid confusion. The staff finds the applicant’s response acceptable because the applicant clarified that all inspections will be performed only on components at CNS and has amended the LRA by removing this statement to avoid confusion.

In comparing the elements in the applicant’s program to those in GALL AMP XI.M32, as clarified by the applicant’s response to the RAI, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent.

Operating Experience. The staff reviewed the OE provided in the LRA Section B.1.29 and interviewed the applicant’s technical staff to confirm that the plant-specific OE did not reveal any degradation not bounded by industry experience. In the application, the applicant indicated that One-Time Inspection Program is a new program, and the industry’s OE will be considered when implementing this program. The applicant further indicated that the plant-specific OE for this AMP will be gained as it is implemented during the period of extended operation, and will be factored into the program via the confirmation and corrective action elements of the CNS QA Program in accordance with 10 CFR 50 Appendix B. In order to be consistent with the staff’s recommendations in Section A.1.2.3.10, item 2 of SRP-LR Branch Technical Position (BTP) RLSB-1 (i.e., BTB RLSB-1 of Appendix A to NUREG-1800), an applicant may have to commit to providing OE for new programs in the future to confirm their effectiveness.

The staff interviewed the applicant’s technical personnel, and conducted an independent search of the applicant’s condition report data base during the audit to confirm that plant-specific OE did not reveal any degradation not bounded by industry experience. The staff found that the OE provided by the applicant was consistent with that identified in the staff’s independent search and that none of the OE reviewed indicated any degradation not bounded by industry experience. The staff noted in LRA Section B.1.29 that this is a new program, and future industry OE will be considered when implementing this program. The applicant indicated that the plant-specific OE for this AMP will be gained as it is implemented during the period of extended operation, and will be incorporated into this program by the confirmation process and corrective action program elements in accordance with 10 CFR 50 Appendix B QA program.

The staff confirmed that the “operating experience” program element satisfies the criteria defined in the GALL Report and in SRP-LR A.1.2.3.10. The staff finds this program element acceptable.

USAR Supplement. LRA Section A.1.1.29 provides the applicant’s USAR supplement for the One-Time Inspection Program. The staff confirmed that the applicant’s USAR supplement summary description for this program conforms to the staff’s recommended USAR Supplement guidance found in the SRP-LR.

In Commitment No. NL2008071-20, the applicant committed to implementing this new program prior to the period of extended operation.

The staff determines that the information in the USAR supplement is an acceptable summary description of the One-Time Inspection Program in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's One-Time Inspection Program, and the applicant's responses to the RAI, the staff finds that those program elements for which the applicant claimed consistency with the GALL Report is confirmed. The staff also reviewed Commitment No. NL2008071-20, which states this program will be implemented prior to the period of extended operation. The staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an acceptable summary description of the program, in accordance with 10 CFR 54.21(d).

3.0.3.1.11 One-Time Inspection – Small Bore Piping Program

Summary of Technical Information in the Application. LRA Section B.1.30 describes the new One-Time Inspection – Small Bore Piping Program as consistent with GALL AMP XI.M35, "One-Time Inspection of ASME Code Class 1 Small Bore Piping." The applicant indicated that the program is applicable to small bore ASME Code Class 1 piping less than 4 inches nominal pipe size (NPS), which includes pipe, fittings, and branch connections. The ASME Code does not require volumetric examination of Class 1 small bore piping. The applicant also indicated that the CNS One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program will manage cracking through the use of volumetric examinations, and that the inspection provides additional assurances that the aging of small bore ASME Code Class 1 piping is not occurring. The applicant further indicated that implementation of the program is scheduled to be completed during the 10-year period prior to the period of extended operation. The applicant proposes the new program in Commitment No. NLS2009071-21.

Staff Evaluation. During the audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the applicant's AMP evaluation for the One-Time Inspection – Small Bore Piping Program, together with the applicant's program outline which provides specific guidance for preparation of implementing procedures related to this new program. In comparing the program description and elements in the applicant's AMP to those in GALL AMP XI.M35, the staff verified that the program description and elements that the applicant claimed to be consistent with the GALL Report are indeed consistent with the corresponding program element criteria recommended in GALL AMP XI.M35. However, the staff also noted that no specific information was provided on how small bore piping socket welds are addressed. Specifically, GALL AMP XI.M35 recommends volumetric examination of certain small bore piping including socket welds. The applicant indicated that there are hundreds of socket welds up to 2 inches in diameter in the plant, but there have been no qualified techniques to volumetrically examine small bore socket welds.

In a letter dated May 1, 2009, the staff issued RAI B.1.30-1 requesting the applicant's method of addressing the small bore socket welds. In a letter dated June 15, 2009, the applicant provided its response to the RAI stating that:

> NUREG Section XI.M35 does not explicitly address socket welds. Because there is no accepted industry standard method for volumetric examination of socket welds, no such examinations are included in the CNS program. Small bore Class 1 piping inspections at CNS are consistent with the staff-approved Inservice Inspection (ISI) Program and meet ASME Code Section XI IWB, small-bore piping requirements. The provisions of Section

XI require surface examination of a sample of socket welds and VT-2 examination of a sample of socket welds and VT-2 examination of all Class 1 socket welds each RFO. A review of plant-specific OE at CNS identified no history of cracking in Class 1 small bore piping including socket welds.

The staff disagrees with the statement in the CNS response and provided additional clarification to the applicant in a conference call on July 27, 2009.

With respect to the applicant's response, that "NUREG-1801, Section XI.M35 does not explicitly address socket welds," the staff's position is that Section XI.M35 recommends one-time inspection of Class 1 small bore piping, which includes piping, branch connections, and welds of any kind. Therefore, socket welds are included as part of Section XI.M35.

With respect to the applicant's statement that "because there is no accepted industry standard method for volumetric examination of socket welds, no such examinations are included in the CNS program," the staff also disagrees. While the staff understands the applicant's point regarding no industry-wide standard, the staff also does not necessarily take that to mean that in lieu of such a standard, a VT-2 is sufficient in addressing the intent of the GALL AMP XI.M35. In its November 16, 2009, response, the applicant correctly cited the operating experience attribute of the AMP XI.M35 to state that the volumetric technique "needs to be qualified before the examination." However, the applicant was incorrect in interpreting that to mean that a VT-2, in accordance with its ASME Class 1 small-bore piping inspection, is the only other viable option. In fact, for the subject socket welds, the staff does not consider the performance of surface and VT-2 inspections to be a suitable alternative to volumetric inspections as a means of detecting cracking of socket welds in ASME Class 1 small-bore piping. Specifically, these types of inspections are not effective for detecting pre-existing cracks initiated from the inside surface. This is partly the reason behind the GALL AMP XI.M.35 recommending volumetric examinations.

The applicant has not demonstrated further effort to address viable alternatives for examining socket welds other than in pointing out a lack of industry standard. The staff's interpretation of the operating experience attribute in AMP XI.M35, specifically where its states that the volumetric technique "needs to be qualified," is that the applicant should provide some demonstrated technique that is capable of detecting the flaws of relevant size and character for socket welds. Where the applicant states that none exists, the staff notes that there have been efforts made by industry to attempt UT specifically on socket welds, and in some cases, these efforts have achieved some limited success. In addition, other options have also been used in industry, including destructive examination of welds opportunistically such as during pipe replacements for plant modifications. In addition, the volumetric technique, as discussed in the GALL Report, is not intended to preclude applicants from trying alternate techniques that may be available, but rather to encourage them to take all steps to demonstrate that early signs of failure could be detected. In its response to the staff regarding this issue, the applicant has not provided the staff information regarding its effort to look further at other options to manage aging effects of socket welds at CNS.

In a letter dated October 15, 2009, the staff issued RAI B.1.30-2 to further request that the applicant review and consider relevant industry OE to determine whether its previous conclusion regarding socket welds would change. In the RAI, the staff provided information regarding its own cursory review of such OE, where it identified several examples of socket weld failures resulting from cracking on the inside diameter (below the visible surface of the weld) stemming from intergranular stress corrosion and fatigue.

In a letter dated November 16, 2009, the applicant provided a response to RAI B.1.30-2. Its response stated that the applicant's review of the failures cited in the industry OE indicated that they were the result of high-cycle fatigue cracking due to vibration or weld defects during installation, which the applicant does not interpret to be related to the effects of aging. In the same response, the applicant also noted that "prior to 2004 NPPD experienced socket weld cracking due to high-cycle fatigue from excessive vibration that was not related to the effects of aging.." The applicant's response, however, did not contain any further details about the nature of this failure and how or if the root-cause analysis arrived at the conclusion that it was not aging related.

In accordance with GALL AMP XI.M35, for plants that have experienced cracking, the GALL Report recommends periodic inspection of the subject piping to be managed by a plant-specific AMP. The staff found that the applicant should provide a plant specific AMP that includes periodic inspections for ASME Code Class 1 small-bore piping during the period of extended operation, or provide justification why a plant-specific AMP is not necessary. During the conference call of January 8, 2010, the staff notified the applicant of this issue.

In light of the socket weld failures reported by the industry OE discussed above, the staff is concerned that such failures may be attributable to aging effects. The nature of high-cycle fatigue, i.e., cyclic loading over a period of time, establishes a plausible case to suspect that aging could be factor, and if left unmonitored, the subject socket welds could fail over an extended period of use, especially in plants that have experienced cracking like CNS. Therefore, consistent with GALL AMP XI.M35, a periodic inspection of the subject piping and socket welds under a plant-specific AMP at CNS is appropriate for license renewal.

Because the applicant did not adequately address or provide a plant-specific AMP that includes periodic volumetric inspections for ASME Code Class 1 small-bore piping, including socket welds, during the period of extended operation, this issue remains unresolved. This is an open item OI 3.0.3.1-1.

Operating Experience. The staff reviewed the OE described in the LRA Section B.1.30. The applicant indicated that the Small Bore Class 1 Piping Inspection Program is a new one-time inspection activity for which there is no OE and that inspection methods will be consistent with accepted industry practices. For this program and for other new AMPs where the applicant provided no current plant-specific OE, the staff issued a generic RAI B.1.30-1.

In RAI B.1.30-1, dated May 1, 2009, the staff requested that the applicant commit to provide documentation of plant-specific OE for staff review, after the program has been implemented, but, prior to entering the period of extended operation.

Based on discussions with the applicant, this program was previously a part of the ISI Program. Therefore, there is applicable OE on small bore piping inspection at CNS. The staff audited the OE reports, including three condition reports, and interviewed the applicant's technical staff to confirm that the plant-specific OE did not reveal any degradation not bounded by industry experience. The staff verified that the OE described in the applicant's basis document acceptably addresses the plant-specific OE for this AMP.

The staff concludes that the Corrective Action Program, based on plant-specific and industry experience, captured OE to support the conclusion that the effects of aging are acceptably managed. On this basis, the staff confirmed that the "operating experience" program element satisfies the criteria defined in the GALL Report and the guidance found in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

USAR Supplement. The applicant provided the USAR supplement summary for the Small Bore Class 1 Piping Inspection Program in LRA Section A.1.1.30, Commitment No. 27. The staff reviewed this section, as revised in response to RAI B.1.30-1, and finds it acceptable because it is consistent with the corresponding program description in SRP-LR Table 3.1-2. The staff also notes that the applicant has committed to implement the Small Bore Class 1 Piping Inspection Program for aging management of applicable components during the 10-year period prior to the period of extended operation. The staff determines that, pending resolution of the open item, the information in the USAR supplement is an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of the review of the applicant's Small Bore Class 1 Piping Inspection Program, the staff finds that, after incorporation of all LRA and program revisions made in response to the staff's RAIs, all program elements are consistent with the GALL Report. The staff concludes that, pending resolution of the open item, 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 in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

3.0.3.1.12 Selective Leaching Inspection Program

Summary of Technical Information in the Application. In LRA Section B.1.34, the applicant described the new Selective Leaching Program as consistent with GALL AMP XI.M33, "Selective Leaching of Materials." The applicant indicated that its program combines the use of a visual inspection with a hardness test on the external and internal surfaces of materials susceptible to selective leaching, to determine whether the aging effect of loss of material due to selective leaching has occurred. The applicant also indicated that the Selective Leaching Program will insure the integrity of cast iron, bronze, brass, and other alloys exposed to condensation, raw water, treated water, steam, and soil (groundwater) that may lead to selective leaching.

Staff Evaluation. During its audit, the staff reviewed the applicant's program basis document to confirm the claim of consistency with the GALL Report. The staff reviewed the applicant's engineering report on AMP evaluation results for selective leaching, and confirmed that the program scope includes all systems that could be susceptible to selective leaching. The staff noted that this includes copper alloys (brass and bronze), cast iron, and other alloys exposed to raw water, steam, treated water, and soil (groundwater). The staff confirmed that the plant program contains all of the elements of the referenced AMP XI.M33 in the GALL Report. The staff conducted onsite interviews with the applicant to verify the Selective Leaching Program planning basis and implementation. During the audit, the staff confirmed the applicant's claim of consistency with the GALL Report for AMP element 5, "monitoring and trending." In comparing the elements in the applicant's program basis document to those in the GALL Report AMP XI.M33, the staff determined that additional clarification of the program basis document descriptions was required to determine the adequacy of the AMP elements 1, 2, 3, 4, 6, and 10 for "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "acceptance criteria," and "operating experience." The applicant's program basis for each of these elements required clarification, as follows:

- For element 1, "scope of program" the description identified that it would include hardness measurements, where feasible, or other accepted mechanical inspection techniques; but, it did not specify the basis for this or identify what is considered as “other accepted mechanical inspection techniques.”

- For element 2, the GALL Report XI.M33 states that it is an inspection/verification program with no preventive action; however, it also notes that monitoring of water chemistry is effective in reducing selective leaching. In reviewing the program basis documents, it was not clear to the staff whether or not the applicant will utilize water chemistry monitoring for this program.

- For element 3, “parameters monitored/inspected,” the inspection and measurements would be done, where feasible, based on form and configuration, and mechanical inspection techniques other than hardness could be used. It does not provide a description of the methods or techniques to be used, or identify specifics of the testing or inspection techniques.

- For element 4, “detection of aging effects,” the applicant’s program basis document identified the material/environment combinations that this AMP is credited with managing for selective leaching and stated that they would be inspected/tested, where feasible, by hardness testing or other accepted mechanical inspection techniques. However, it does not identify how and when these inspections/tests will be applied to detect internal or external corrosion caused by selective leaching.

- For element 6, “acceptance criteria,” stated that, in compliance with the GALL Report AMP XI.M33, identification of selective leaching will define the need for further engineering evaluation, and, if necessary, a root cause analysis. It did identify what the acceptance criteria for hardness or other mechanical techniques are, and what would constitute “identification of selective leaching.”

- For element 10, “operating experience,“ the applicant stated (during interviews) that the plant had no OE that would indicate selective leaching had occurred. However, the LRA and the program basis document for this AMP element do not state this.

The staff issued RAI B.1.34-1, dated May 1, 2009, requesting that the applicant provide additional description of the basis, actions, support, and specifics for these GALL Report AMP program elements.

The applicant responded to RAI B.1.34-1 by letter dated June 15, 2009, providing additional descriptions of the basis, actions, support, and specifics of the requested six AMP elements as follows:

- For element 1, “scope of program,” the applicant clarified that qualitative determination of selective leaching or other mechanical means such as scraping, chipping, or probing with a sharp tool may be used and are valid methods to identify selective leaching.

- For element 2, “preventive actions,“ the applicant noted that although there are no preventive actions associated with this AMP, part of the CNS water chemistry programs, including monitoring of water chemistry to control potential of hydrogen (pH) and concentrations of corrosive contaminants and minimizing dissolved oxygen (DO) in treated water, are effective in reducing selective leaching.

- For element 3, “parameters monitored or inspected,” the applicant described typical industry instances of selective leaching such as graphitization in gray cast iron and dezincification in copper alloys, and described the methods and validity of inspection and testing to include hardness and other mechanical testing and visual inspection.

- For element 4, “detection of aging effects,” the applicant indicated that the visual inspection and hardness measurement is to be a one-time inspection performed on a selected set of components that are potentially susceptible to selective leaching, just before the period of extended operation. The response further indicated that visual inspection with either Brinell hardness testing or examination by mechanical means such as scraping, chipping, or probing with a sharp tool could be employed to determine the presence of selective leaching.

- For element 6, “acceptance criteria,” the applicant identified acceptance criteria for each of the inspection techniques of Brinell hardness, mechanical means, and visual examination. The applicant further indicated that if the acceptance criteria are not met, further engineering evaluation would be initiated under the plant corrective action program, including root cause analysis if necessary.

- For element 10, “operating experience,” the applicant stated that its review of OE at CNS identified no occurrence of selective leaching.

Based on its review, the staff finds the applicant’s response to RAI B.34-1 acceptable because it satisfactorily answered the questions posed in the RAI. The staff’s concerns described in RAI B.1.34-1 are resolved.

Based on its review, including the applicant’s responses to the RAI, the staff finds the Selective Leaching Program consistent with the program elements in GALL AMP XI.M33, and therefore acceptable.

Operating Experience. The staff reviewed the OE described in LRA Section B.1.34, and interviewed the applicant’s technical personnel during the audit to confirm that plant-specific OE did not reveal any degradation due to selective leaching or not bounded by industry experience. In its response to RAI B.1.34-1 noted above, the applicant confirmed that no selective leaching had been observed at CNS. The applicant in the LRA indicated that the Selective Leaching Program is a new program for which there is no OE and that industry OE will be considered when implementing this program. The applicant further indicated that plant-specific OE for this AMP will be gained as the program is implemented during the period of extended operation, and will be factored into the program via the confirmation and corrective action element of the CNS QA Program in accordance with 10 CFR 50 Appendix B. The staff also conducted an independent search of the plant-specific OE during the audit and found no indication of age-related degradation attributable to selective leaching.

The staff confirmed that the "operating experience" program element satisfies the criteria defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

USAR Supplement. The applicant provided the USAR supplement summary for the Selective Leaching Program in LRA Section A.1.1.34. The staff confirmed that the applicant's USAR supplement summary description for this program conforms to the staff's recommended USAR Supplement guidance found in the SRP-LR. In Commitment No. NLS2008071-24, the applicant committed to implement the Selective Leaching Program prior to the period of extended operation.

The staff determined that the information in the USAR supplement is an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of the review of the applicant's Selective Leaching Program, including the applicant's RAI B.1.34-1 responses, the staff finds that all program elements are consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions of these components will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

3.0.3.1.13 Service Water Integrity Program

Summary of Technical Information in the Application. LRA Section B.1.35 describes the existing Service Water Integrity Program as being consistent with GALL AMP XI.M20 "Open-Cycle Cooling Water System." The applicant indicated that by using this program, it proposes to manage the effects of corrosion in the service water system via a combination of internal coatings, periodic inspections and performance tests.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The following five instances of potential inconsistency were observed. These issues involve

- chemical water treatment
- uncoated piping
- ensuring heat transfer capabilities
- detecting biofouling
- conforming with Generic Letter (GL) 89-13

These issues are addressed in the paragraphs below.

Program element 2, "preventive actions" of the GALL Report AMP, states that chemical water treatment should be used whenever the potential for biofouling species exists. In the corresponding element of the LRA AMP, the applicant indicated that chemical treatment is not used for biological control. The applicant also stated that macro biofouling organisms have not been found at the plant. The staff notes that neither of these statements was consitent with the information reviewed in the OE and the applicant's responses to staff questions.

By letter dated May 1, 2009, the staff issued RAI B.1.35-1 requesting that the applicant update the information concerning the presence of biofouling species and the use of chemical water treatment.

The applicant responded by letter dated June 15, 2009, stating that Asiatic clams had been detected at the plant but Zebra mussels had not. The applicant also indicated that beginning in 2008, chemical treatment was used on a biannual basis and the Service Water Integrity Program includes on-going periodic chemical treatments of the service water system to control mollusks. The applicant further indicated that the program was effective because no live clams have been found in the control bio-box or in plant components opened for inspection. The staff finds this response acceptable because the LRA AMP is now consistent with the GALL Report AMP in terms of the use of chemical treatment and because that chemical treatment has been shown to be effective. The staff's concern described in RAI B.1.35-1 is resolved.

In the GALL Report AMP, element 2, "preventive actions," states that system components are to be constructed of appropriate materials and lined or coated to protect the underlying metal surfaces from being exposed to aggressive cooling water environments. The LRA AMP states that some open cycle cooling water piping is unlined. It is well established in the corrosion literature that unlined pipe may corrode at rates higher than experienced by lined pipe. Given that the GALL Report AMP is based on the use of lined pipe, the staff expects that the applicant's use of unlined piping may result in corrosion rates in excess of those anticipated by the GALL Report AMP. By letter dated May 1, 2009, the staff issued RAI B.1.35-2 asking why the LRA AMP should be considered consistent with the GALL Report AMP.

The applicant responded by letter dated June 15, 2009, stating that the raw water environment is not aggressive based on plant-specific operating experience which shows that the overall condition of the service water system is good with thirty years of service. The applicant also stated that the open cycle cooling system was constructed of appropriate materials as defined by the original design specifications for the expected environment and that coatings or linings have been installed in specific areas where appropriate. The applicant further stated that the program element "parameters monitored" of the GALL Report AMP, does not require coatings in all locations. The staff finds the applicant's response acceptable because, (1) as originally designed, specific portions of the service water system are coated or lined, (2) while the staff considers aerated water to generally be corrosive to carbon steel, the applicant's plant specific operating experience demonstrates that the overall condition of the service water system is good, and (3) the LRA AMP implements Generic Letter 89-13 which requires periodic inspections for corrosion and erosion. The staff's concern described in RAI B.1.35-2 is resolved.

In the GALL Report AMP program element 3, "parameters monitored" states that the system should be periodically "inspected, monitored or tested to ensure heat transfer capabilities." The corresponding program element in the LRA AMP states that the AMP ensures "cleanliness and material integrity." Ensuring cleanliness and material integrity is not necessarily equivalent to ensuring heat transfer capabilities. By letter dated May 1, 2009, the staff issued RAI B.1.35-3 requesting that the applicant modify the proposed AMP to be consistent with the AMP recommended by the GALL Report or to suggest an acceptable alternative.

The applicant responded by letter dated June 15, 2009, indicating that heat transfer capabilities are tested for applicable heat exchangers and that cleanliness and material integrity are verified by visual inspection for other components. The staff finds this response acceptable because the applicant has confirmed that heat transfer capabilities of heat exchangers will be tested as recommended by the GALL Report AMP. The staff's concern described in RAI B.1.35-3 is resolved.

In the GALL Report AMP program element 4, “detection of aging effects” includes biofouling as an aging effects/mechanism. However, in the corresponding section of the LRA, the applicant did not include biofouling as an applicable aging effects/mechanisms to be considered. By letter dated May 1, 2009, the staff issued RAI B.1.35-4 requesting that the applicant revise the proposed AMP to include the detection of biofouling in the program element, “detection of aging effects.”

The applicant responded by letter dated June 15, 2009, stating that it did not consider biofouling to be an aging effect which is separate and distinct from other aging effects. The applicant also stated that the program monitors for the three principal effects of biofouling, including component inspections for blockage, performance testing to verify heat transfer, and inspections for loss of material due to a potentially more aggressive corrosion environment created by the accumulation of the biofouling material. The staff finds this response acceptable because the intent of the biofouling portion of the AMP, (i.e., the detection and control of biofouling) is included in the AMP in a manner which has a reasonable assurance of success. The staff’s concern described in RAI B.1.35-4 is resolved.

GL 89-13 establishes a variety of inspections and tests recommended to adequately maintain a service water system. Included within these recommendations are testing intervals or frequencies. While many of these testing intervals are implicitly acknowledged by the applicant in supporting documents, explicit acknowledgement of some of the testing intervals appears to be lacking in documentation which can be readily connected to this AMP.

By letter dated May 1, 2009, the staff issued RAI B.1.35-5 requesting that the applicant identify all testing and inspection recommendations contained in GL 89-13, provide all testing intervals being utilized by the plant, and demonstrate that these intervals are consistent with the recommendations of GL 89-13.

The applicant responded by letter dated June 15, 2009. In its response the applicant documented eight specific inspection, testing and performance monitoring activities conducted by the station (e.g., inspection of intake structure for silt, debris, biological fouling mechanisms, and material loss; pump performance monitoring, heat transfer capability testing, selected UT wall thickness measurements) that demonstrate compliance to the three actions required by generic Letter 89-13. The applicant also stated that a review of plant-specific operating experience has demonstrated that the program has been effective at managing the aging effects. The staff finds this response acceptable because the information provided was consistent with the recommendations of the GALL Report AMP and GL 89-13. The staff’s concern described in RAI B.1.35-5 is resolved.

Based on its review, the staff finds that elements one through six of the applicant’s proposed Service Water Integrity AMPs are consistent with the corresponding program elements of GALL AMP XI.M20, and therefore, acceptable.

Operating Experience. The staff reviewed the OE provided in the LRA, interviewed the applicant's technical personnel, and conducted an independent search of the applicant’s condition report data base during the audit to confirm that plant-specific OE did not reveal any degradation not bounded by industry experience. The staff found that the OE provided by the applicant was consistent with that identified in the staff’s independent search and that none of the OE reviewed indicated that the LRA AMP would be inadequate in managing the aging effects under consideration.

The staff confirmed that the “operating experience” program element satisfies the criteria defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

USAR Supplement. The applicant’s USAR supplement for the Service Water Integrity AMP is provided in LRA Section A.1.1.35.The staff reviewed the USAR supplement and determined that the information in the USAR supplement conforms to the description of this program contained in the SRP-LR and is, therefore, an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant’s Service Water Integrity AMP, including the applicant’s responses to the RAIs, the staff finds that all program elements are consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

3.0.3.1.14 Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel Program

Summary of Technical Information in the Application. LRA Section B.1.37 describes the new Thermal Aging and Neutron Irradiation Embrittlement of CASS Program as consistent with the GALL AMP XI.M13, “Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS).” The applicant indicated that this AMP will assure reduction of fracture toughness due to thermal aging and reduction of fracture toughness due to radiation embrittlement will not result in loss of intended function. This AMP includes (a) identification of susceptible components determined to be limiting from the standpoint of thermal aging susceptibility (i.e., ferrite and molybdenum contents, casting process, and operating temperature) and/or neutron irradiation embrittlement (neutron fluence), and (b) for each “potentially susceptible” component, aging management accomplished through either a supplemental examination of the affected component during the period of extended operation, or a component-specific evaluation to determine its susceptibility to reduction in fracture toughness.

Staff Evaluation. During its audit, the staff reviewed the applicant’s claim of consistency with the GALL Report. The staff reviewed LRA Chapter 3, Table 3.1.1 and found that in item 3.1.1-51, the applicant indicated that this program manages the reduction of fracture toughness in jet pump assembly castings and fuel support pieces with orifices. The applicant indicated in item 3.1.1-57 that the reduction of fracture toughness in the control rod guide tube bases, which are not part of the pressure boundary, is also managed by the Thermal Aging and Neutron Irradiation Embrittlement of CASS Program. The applicant also stated in item 3.1.1-57 that CNS has no other Class 1 piping, piping components, piping elements, or CRD housings made of CASS.

The staff found that applicant had not determined if niobium-containing CASS material was used in any RVI components. The GALL Report states that the screening criteria for susceptibility to thermal aging embrittlement are not applicable to niobium-containing steels; such steel requires evaluation on a case-by-case basis. Consequently, by letter dated May 1, 2009, the staff issued RAI B.1.37-1 to request that the applicant determine if niobium-bearing

CASS material is used for any RVI components and if so, to provide a program for staff evaluation.

The applicant responded by letter dated June 15, 2009, and stated that consistent with the statement on page six of the letter from the NRC to NEI dated May 19, 2000 (Grimes letter), the CASS components are not expected to contain niobium. The applicant also stated that the GALL Report statement regarding niobium indicates that the screening criteria are not applicable; not that the program is not applicable to niobium-bearing materials. The applicant made a commitment in its response letter that if niobium is found to be a constituent of any CASS component material, the component will be considered susceptible to thermal aging embrittlement without the application of the screening criteria. The applicant further stated that consistent with any other component found susceptible to thermal aging embrittlement, they will be examined via a supplemental inspection in accordance with the GALL AMP XI.M13.

Based on its review the staff finds that the applicant has not adequately addressed the staff's concerns. Therefore, until the applicant either confirms that there are no niobium-bearing CASS materials used for RVI components, or provide (or make a commitment to provide) a flaw evaluation methodology for niobium-bearing CASS internal components for staff review, the staff's concerns in RAI B.1.37-1 are unresolved. On September 21, 2009, a telephone conference call was conducted with the applicant to discuss this issue. During the conference call, the applicant indicated that it would commit to either confirm that there is no niobium-bearing CASS material used for the RVI components, or provide a flaw evaluation methodology for niobium-bearing CASS RVI components to the staff prior to the extended period of operation. By letter dated March 29, 2010, the applicant submitted Commitment No. NLS2009100-2 to confirm its statement.

The staff's review of the applicant's program also showed that the applicant had not confirmed that there is no CASS material with greater than 25 percent ferrite. The GALL Report states that flaw evaluation for CASS components with greater than 25 percent ferrite is performed on a case-by-case basis using fracture toughness data provided by the applicant. The applicant stated, "Flaw evaluation for CASS components with greater than 25 percent ferrite content will be developed on a case-by-case basis using fracture toughness data. The applicable BWRVIP guidelines will be used for flaw evaluation of internal components for which IWB-3500 and IWB-3640 are not applicable." It is not clear to the staff what the applicant meant by "applicable BWRVIP guidelines" because none of the BWRVIP documents address the reduction of fracture toughness due to thermal aging embrittlement and neutron irradiation embrittlement. By letter dated May 1, 2009, the staff issued RAI B.1.37-2 requesting that the applicant clarify what is meant by applicable BWRVIP guidelines. Also, unless it can be confirmed that there is no CASS material with greater than 25 percent ferrite, the applicant was asked to provide a flaw evaluation methodology for CASS internal components with greater than 25 percent ferrite for staff review.

The applicant responded by letter dated June 15, 2009, stating, "Although the BWRVIP documents do not address the reduction of fracture toughness due to thermal aging and neutron embrittlement, guidance developed through industry initiatives would be disseminated by and included in the BWRVIP documents." The applicant also stated that, prior to the period of extended operation (as part of the program implementation) the specific composition of CASS materials and casting methods used for the components in the RVI components will be established and potentially susceptible components will be evaluated to determine whether or not they are not susceptible to reduction of fracture toughness. If they are susceptible, they will be scheduled for examination via a supplemental inspection. The applicant further stated, "If components with greater than 25 percent ferrite are identified, found to be potentially susceptible to reduction of fracture toughness, and scheduled for a supplemental inspection, CNS will determine the appropriate methodology for flaw evaluation in accordance with available BWRVIP guidance."

Based on its review the staff finds that the applicant has not adequately addressed the staff's concerns. Until the applicant can either confirm that there are no CASS materials with greater than 25 percent ferrite or provide a flaw evaluation methodology for CASS internal components with greater than 25 percent ferrite, and include this commitment in CNS Commitment No. NLS2008071-26, the staff's concerns in RAI B.1.37-2 are unresolved. On September 21, 2009, a telephone conference call was conducted with the applicant to discuss this issue. During the conference call, the applicant indicated that it would commit to provide either a confirmation that there are no CASS materials with greater than 25 percent ferrite or a flaw evaluation methodology for CASS materials with greater than 25 percent ferrite to the staff prior to the period of extended operation. By letter dated March 29, 2010, the applicant provided Commitment No. NLS2009100-3 to confirm its statement.

In addition, based on the review of the applicant's documents, including the USAR supplement, the staff could not determine if this program was consistent with the program element, "scope of program" in GALL AMP XI.M13 which states: "For potentially susceptible components, the program provides for the consideration of the synergistic loss of fracture toughness due to neutron embrittlement and thermal aging embrittlement." The omission of this information in the USAR supplement suggests that the program element, "scope of program" may not be consistent with the GALL Report program. Therefore, by letter dated May 1, 2009, the staff issued RAI B.1.37-3 requesting that the applicant clarify whether or not the program accounts for the synergistic effects of thermal aging and neutron embrittlement, and if does, explain how the synergistic effects of thermal aging and neutron embrittlement are considered in the program or provide a reference where this information is available. Also, the applicant was requested to explain the inconsistency between LRA Section A.1.1.37 and SRP-LR, Table 3.1-2 regarding the consideration of the synergistic loss of fracture toughness due to neutron embrittlement and thermal aging embrittlement.

In response to RAI B.1.37-3, by letter dated August 13, 2009, the applicant indicated that USAR Section A.1.1.37 is revised to address the limiting variables that affect thermal embrittlement susceptibility in CASS materials (i.e., ferrite content and molybdenum content) and synergistic effects of thermal and neutron embrittlement in CASS materials. The staff accepts this response and considers that its concerns related to RAI B.1.37-3 are closed.

The staff's review of the Thermal Aging and Neutron Irradiation Embrittlement of CASS Program confirmed that upon satisfactory resolution of the staff's concerns discussed in the RAIs, the boundary conditions of the plant program will be consistent with the boundary conditions described in the GALL Report program.

Based on its review, the staff finds that the applicant's Thermal Aging and Neutron Irradiation Embrittlement of CASS Program consistent with the program elements of GALL AMP XI.M13, and therefore acceptable.

<u>Operating Experience</u>. The staff also reviewed the OE described in LRA Section B.1.37 and interviewed the applicant's technical staff to confirm that the plant-specific OE did not reveal any degradation not bounded by industry experience. In the application, the applicant indicated that the Thermal Aging and Neutron Irradiation of CASS Program is a new program, and industry's OE will be considered when implementing this program. The applicant further stated that plant-specific OE for this AMP will be gained as the program is implemented during the period of

extended operation, and will be factored into the program via the confirmation and corrective action elements of the CNS 10CFR Part 50, Appendix B QA 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.

USAR Supplement. In LRA Section A.1.1.37, the applicant provided the USAR supplement for the Thermal Aging and Neutron Irradiation Embrittlement Program. The staff reviewed this section and the applicant’s proposed revision to Section A.1.1.37 of the USAR, and determined that the information in the USAR supplement provided an adequate summary description of the Thermal Aging and Neutron Irradiation of CASS Program in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant’s AMP for the CASS materials, including the applicant’s response to RAI numbers B.1.37-1 through B.1.37-3, the staff finds that all program elements are consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it is in accordance with 10 CFR 54.21(d).

3.0.3.1.15 Water Chemistry Control – Boiling-Water Reactor Program

Summary of Technical Information in the Application. LRA Section B.1.39 describes the existing Water Chemistry Control – BWR Program as consistent with GALL AMP XI.M2, “Water Chemistry.” The applicant indicated that this program manages aging effects caused by corrosion and cracking mechanisms through monitoring and control of water chemistry based on the EPRI Report 1008192 (BWRVIP-130). The applicant also indicated that BWRVIP-130 has separate guidelines for primary water, condensate and FW, and CRD mechanism cooling water. It includes recommendations for controlling water chemistry in the torus/pressure suppression chamber, condensate storage tank, demineralization water storage tanks, and spent fuel pool.

The applicant indicated that the program optimizes the primary water chemistry to minimize the potential for loss of material and cracking by limiting the levels of contaminants in the RCS and by hydrogen water chemistry (HWC) and noble metal chemical addition (NMCA) to reduce DO. The applicant further stated that a one-time inspection program is used to verify the effectiveness of the Water Chemistry Control – BWR Program to manage the aging effects.

Staff Evaluation. During its audit, the staff reviewed the applicant’s claim of consistency with the GALL Report. The staff reviewed the applicant’s LRA and accompanying documentation, including relevant chemistry, system operating, and administrative procedures. The staff also reviewed condition reports and abnormal occurrence notifications related to the Water Chemistry Control – BWR Program. The staff noted that the applicant’s program relies on monitoring and control of reactor water chemistry based on the guidance of BWRVIP-130 (EPRI-008192), which is a later revision to BWRVIP-29 and is acceptable because the GALL Report recommends that the use of a later revision is acceptable.

During its audit, the staff reviewed the operating procedures for this program and noted that the procedure for startup/hot standby conditions specifies that an Action Level 3 condition is reached when the reactor water conductivity exceeds 2.0 μmho/cm (a common conductance unit). This is consistent with and, in fact, more conservative than the corresponding value of

5.0 µmho/cm given in BWRVIP-130. The applicant's procedure also specifies that an alternative Action Level 3 value of 20 µmho/cm applies during noble metal application, but does not indicate the duration for this increased conductivity transient. Therefore, by letter dated May 1, 2009, the staff issued RAI B.1.39-1 requesting that the applicant define the time duration for the conductivity transient following noble metal application for which the applicant's Action Level 3 value of 20 µmho/cm applies.

The applicant responded by letter dated June 15, 2009, and indicated that the time duration for the conductivity transient following noble metal application is defined in its documentation in the Technical Requirements Manual (TRM) TLCO 3.4.1, as up to 48 hours of noble metal injection, followed by up to 24 hours for restoration to acceptable chemistry limits. Based on its review, the staff finds the applicant's response to RAI B.1.39-1 acceptable because it satisfactorily answers the question posed in the RAI. The staff's concern described in RAI B.1.39.1 is resolved.

The staff further notes that for power operating conditions, the applicant's procedure specifies that an Action Level 1 condition is reached when the reactor water conductivity reaches or exceeds 0.18 µmho/cm, with certain exceptions noted for transient conditions. This is more conservative than the corresponding value of 0.30 µmho/cm given in BWRVIP-130. The applicant's procedure also allows a higher limit of 0.5 µmho/cm when the conductivity is increased "due to soluble iron concentration." However, an exception for higher conductivity limits associated with soluble iron is not noted in BWRVIP-130. Therefore, by letter dated May 1, 2009, the staff issued RAI B.1.39-2 requesting that the applicant provide a justification for the higher conductivity limit and a discussion of the procedure for determining the relative contributions of soluble iron versus more aggressive species to the total conductivity.

The applicant responded by letter dated June 15, 2009, noting that BWRVIP-130 discusses the effects of soluble iron and zinc on water conductivity as a result of starting and stopping hydrogen injection. This report notes that the initiation of hydrogen injection causes the reactor water to transition from an oxidizing to a reducing environment, resulting in increased iron solubility. However, dissolved iron is not an aggressive species with respect to SCC. The applicant also cited BWRVIP-79, the predecessor to BWRVIP-130, which states that for plants starting up with noble metal chemical application, contributions due to soluble iron may be subtracted from the measured conductivity to evaluate conformance to action levels. The applicant further stated that this is the procedure used to compensate for the contribution of soluble iron when assessing action level compliance. Based on its review, the staff finds the applicant's response to RAI B.1.39.2 acceptable because it adequately justifies the higher conductivity limit and satisfactorily explains its procedure for correcting for the contribution of soluble iron to the total conductivity. The staff's concern described in RAI B.1.39.2 is resolved.

Based on its review, including the applicant's responses to the RAIs, the staff finds the Water Chemistry Control – BWR Program consistent with the program elements of GALL AMP XI.M2, and therefore acceptable.

Operating Experience. The staff also reviewed the OE described in LRA Section B.1.39 and interviewed the applicant's technical personnel during the audit to confirm that plant-specific OE did not reveal any degradation not bounded by industry experience. In the LRA, the applicant cited several instances of transients in water chemistry conditions dating back to 2002, and summarized the relevant circumstances and corrective actions taken.

The applicant indicated that in 2002 and 2003, reactor water sulfate levels were briefly above the chemistry warning limit. Parameters were returned to within the normal operating range within the time prescribed by BWRVIP-130, and further corrective action was taken to avoid recurrences. During the period from 2003 to 2005, incidents occurred in which selected water chemistry parameters exceeded the BWRVIP-130 action level 1 acceptance criteria. These parameters were returned to within the normal operating range within the timeframe prescribed in BWRVIP-130, and additional corrective actions were taken. In 2004 and 2006, elevated levels of sulfates and chlorides again exceeded acceptable levels, and effective remedial actions were taken. Finally, in 2007, high water conductivity levels were detected. The cause was determined to be the intrusion of chloride-bearing halogenated hydrocarbons through the reverse osmosis and electrol deionization (EDI) phases of the process stream. An activated charcoal bed was added downstream of the EDI phase, and conductivity values were returned to acceptable levels.

The applicant further indicated that, for all of these occurrences, the Water Chemistry Control – BWR Program had been effective in managing aging effects by monitoring chemistry control parameters and establishing limits for corrective actions. The staff found the applicant's response to the occurrences cited acceptable, to avoid degradation not bounded by industry experience. The staff confirmed that the "operating experience" program element satisfies the criteria defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

USAR Supplement. In LRA Section A.1.1.39, the applicant provided the USAR supplement for the Water Chemistry Control – BWR Program. The staff reviewed this section and found that it complies with the guidelines of BWRVIP-130 (EPRI Report 1008192), which supersedes BWRVIP-29 (EPRI Report TR-103515) and forms the basis for the GALL BWR water chemistry requirements. It also satisfies the recommendations of Table 3.1-2 of NUREG-1800, Revision 1 "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants." The staff determined that the information in the USAR supplement is an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Water Chemistry Control – BWR Program, including the applicant's responses to the RAIs, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

3.0.3.2 AMPs That Are Consistent with the GALL Report with Exceptions or Enhancements

For AMPs that the applicant claimed are consistent with the GALL Report, with exception(s), enhancement(s), or both, the staff performed an audit and review to confirm that those attributes or features of the program, for which the applicant claimed consistency with the GALL Report, were consistent with the GALL Report recommendations. The staff also reviewed the exception(s) and/or enhancement(s) to the GALL Report to determine whether they were acceptable (appropriate and adequate). The results of the staff's audits and reviews are documented in the following sections.

3.0.3.2.1 Bolting Integrity Program

Summary of Technical Information in the Application. LRA Section B.1.2 describes the existing Bolting Integrity Program as consistent, with enhancements, with GALL AMP XI.M18, "Bolting Integrity." The applicant indicated that the Bolting Integrity Program includes periodic inspection of closure and structural bolting for indications of cracking, loss of preload, and loss of material due to corrosion through other credited programs by incorporating NRC and industry recommendations including the following:

- NUREG-1339, "Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants"
- EPRI TR-104213, "Bolted Joint Maintenance & Applications Guide"
- EPRI NP-5769, "Degradation and Failure of Bolting in Nuclear Power Plants"

The program also includes preventive measures to preclude or minimize loss of preload and cracking. The applicant further indicated that this program manages aging effects for bolting of mechanical components regardless of size except reactor head closure studs, which are addressed by the Reactor Head Closure Studs Program.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The staff reviewed the enhancements to determine whether the AMP, with the enhancements, is adequate to manage the aging effects for which the LRA credits it. The enhancement affects the "scope of program," "preventive actions," and the "corrective actions" program elements.

During its audit, the staff reviewed the applicant's onsite documentation supporting the applicant's conclusion that the program elements are consistent with the elements in the GALL Report. The staff also interviewed the applicant's technical staff and reviewed onsite documents. The staff also confirmed that the plant program contains all of the elements of the referenced GALL Report and that the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated.

In comparing the program elements in the applicant's program to the elements in GALL AMP XI.M18, the staff found that the GALL Report "monitoring and trending" program element recommending leak rates to be monitored on a particularly defined schedule was not properly documented in the applicant's Bolting Integrity Program. The staff found that this GALL Report recommendation was not specifically addressed and should possibly be identified as an exception if it is not met. Therefore, in RAI B.1.2-2 dated May 1, 2009, the staff requested that the applicant provide additional information on the leak rate monitoring schedule.

In its response dated June 15, 2009, the applicant stated that an exception was not identified since the GALL Report recommendation seems to imply that the specific leak rate monitoring schedule is merely a possible alternative, and not necessarily the recommended alternative. The applicant supplemented this response by crediting the CNS Corrective Action Program with managing any leaks and determining any immediate response required. Additionally, the applicant credits the CNS Fluid Leak Management Program with managing leaks in conjunction with the Corrective Action Program. The applicant indicated that the Fluid Leak Management Program is based on industry guidance documents including INPO AP-928, "Work Management Process Description," EPRI TR-114761, "Establishing an Effective Fluid Leak Management

Program," and EPRI TR-111413, "Lube Oil System Leakage Mitigation." It includes monitoring and trending to ensure that leaks which do not require immediate removal of equipment or challenge system or component functions are managed and corrected in a timely manner. Furthermore, leaks are classified according to the source and description and are tracked by unique work order numbers which are monitored by system engineering and are observed during daily rounds performed by operators. Based on the justification provided, the staff found the applicant's response and exception to be acceptable.

Additionally, the applicant indicated in LRA Section B.1.2 that its Bolting Integrity Program follows the guidance and standards outlined in NUREG-1339 "Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants," EPRI NP-5769 "Degradation and Failure of Bolting in Nuclear Power Plants", and EPRI TR-104213 "Bolted joint Maintenance & Application Guide." During its onsite AMP audit, the staff found that CNS also references the EPRI NP-5067 Volume 1 and 2 "Good Bolting Practices" as a guidance document for the Bolting Integrity Program. However, GALL AMP XI.M18 identifies only NUREG-1339, EPRI NP-5769, and EPRI TR-104213 as guidance relied upon for the Bolting Integrity Program. The applicant did not include an enhancement or exception related to the use of the EPRI NP-5067 guidance document. The use of guidance and standards not endorsed by the GALL Report brings into question the adequacy of the standards which were applied, as well as possible differences or contradictions between the GALL Report and other guidance documents. Therefore, in RAI B.1.2-1, dated May 1, 2009, the staff requested that the applicant provide additional information on the differences and use of this guidance document

In its response dated June 15, 2009, the applicant stated that the guidance in the EPRI NP-5067 "Good Bolting Practices Volume 1: Large Bolt Manual" and "Good Bolting Practices Volume 2: Small Bolt Manual" do not contradict the information in EPRI NP-5769 or NUREG-1339. The applicant further noted that the EPRI NP-5067 documents are cited both in NUREG-1339 and EPRI NP-5769. Furthermore, the staff noted that a previous NRC determination of the interchangeability of EPRI NP-506 was detailed in a point-by-point comparison of the two sets of documents dated April 1, 2005. This comparison was previously accepted by the staff, and found to adequately address the bolting guidelines in the GALL Report. Based on the justification provided, the staff finds the applicant's response to be acceptable.

The staff also noted that the applicant indicated in LRA Section B.1.2 that the Bolting Integrity Program addresses all bolting, regardless of size, except reactor head closure studs, which are addressed by the Reactor Head Closure Studs Program. Upon closer review of the LRA, the staff has identified 3 items which manage bolting that are credited to be managed by other programs: specifically by the Buried Piping and Tanks Inspection and the Periodic Surveillance and Preventive Maintenance (PSPM) programs. GALL AMP XI.M18 allows for supplementation by other AMPs. However, a review must be performed to ensure that these supplemental programs carry out the aging management recommendations of the Bolting Integrity Program. Since the LRA appears to have contradictory information, it is not clear which AMP will be used to manage the components identified in the three items and how it will be performed. Therefore, in RAI B.1.2-4 dated May 1, 2009, the staff requested that the applicant provide additional information on the use of other AMPs to supplement the Bolting Integrity Program.

In its response dated June 15, 2009, the applicant clarified that the Bolting Integrity Program does, in fact, apply to bolting and torquing practices of all bolting regardless of size except reactor head closure studs, as is stated in the LRA. Furthermore, the applicant explained that the bolting line items in question are located in either buried or submerged environments. Bolts in these environments are coated or wrapped, and the inspection of these coatings and wrappings are conducted in accordance with the Buried Piping and Tanks and PSPM programs. In cases where inspection reveals that bolts were exposed due to degradation or removal of the coating or wrappings for maintenance, the elements of the Bolting Integrity Program would be implemented to assure that the intended function of the bolting is maintained. Therefore, since the Buried Piping and Tanks and the PSPM programs are used to manage the coatings and wrappings on the bolt, and not the bolt itself, the staff finds that they do not need to be credited with supplementing the Bolting Integrity Program. Based on the justification provided, the staff finds the applicant's response to be acceptable.

The staff noted that the Bolting Integrity Program is implemented through plant procedures that are based on NRC approved guidance and that inspections are conducted to manage the loss of material due to general, pitting, crevice corrosion, microbiologically influenced corrosion (MIC) and loss of preload due to thermal effects, gasket creep, and self-loosening.

Enhancement 1. LRA Section B.1.2 defines an enhancement to the GALL Report program element "scope of program." The enhancement was related to the use of EPRI NP-5769 and EPRI TR-104213 to enhance the applicant's guidance for material selection and testing, bolting preload control, ISI, plant operation and maintenance, and evaluation of the structural integrity of bolted joints.

The staff verified that the planned enhancement will include guidance which will meet the intended guidance of the GALL Report AMP. The staff finds this enhancement acceptable because when implemented, the Bolting Integrity Program "scope of program" element will be consistent with the GALL AMP XI.M18 "scope of program" element and will add assurance of adequate management of aging effects.

Enhancement 2. LRA Section B.1.2 defines an enhancement to the GALL Report program element "preventive actions." The enhancement was related to the clarification of guidance to reflect proper selection of materials for low susceptibility to SCC, clarifying the prohibition of using lubricants containing molybdenum disulfide (MoS_2) for bolting at CNS, and specifying that proper gasket compression be visually verified following assembly.

The staff noted that the enhancement did not include details on whether or not existing components would be subject to the enhanced guidance regarding material selection of bolts, selection of lubricants, and proper gasket compression. The staff noted that the lack of detail in this enhancement raises the question of whether or not the proposed changes will address the specifications recommended by the Bolting Integrity Program for existing bolts at CNS since existing bolt materials, lubricants, and gasket compression may not have followed the references recommended by the GALL Report AMP. Therefore, in RAI B.1.2-3 dated May 1, 2009, the staff requested that the applicant provide additional information on the details of the enhancement described.

In its response dated June 15, 2009, the applicant stated that actions have been taken to update bolting to be in accordance with NUREG-1339. The applicant indicated that these actions have included proper material selection, bolting lubricants, and gasket compression, according to the specifications of NUREG-1339. Furthermore, site specific OE has shown that actions taken to existing components were effective. The staff noted that its original concern regarding existing bolting has been satisfied since actions have been taken to bring them into accordance with the GALL Report and specifically NUREG-1339. Based on the justification provided, the staff finds the applicant's response to be acceptable.

The staff verified that the planned enhancement will include guidance which will meet the intended guidance of the GALL Report AMP. The staff finds this enhancement acceptable because when implemented, the Bolting Integrity Program corrective actions program element will be consistent with the GALL AMP XI.M18 preventive actions program element and will add assurance of adequate management of aging effects.

Enhancement 3. LRA Section B.1.2 defines an enhancement to the GALL Report program element “corrective actions.” This enhancement was related to the use of EPRI NP-5769 and EPRI TR-104213 to be included as guidance for replacement of non-Class 1 bolting and degraded structural bolting.

The staff verified that the planned enhancement will include guidance which will meet the intended guidance of the GALL Report AMP. The staff finds this enhancement acceptable because when implemented, the Bolting Integrity Program corrective actions program element will be consistent with the GALL AMP XI.M18 corrective actions program element and will add assurance of adequate management of aging effects.

Based on its review of the enhancements and resolution of the RAIs as described above, the staff finds the Bolting Integrity Program consistent with the program elements of GALL AMP XI.M18, with acceptable enhancements, and therefore acceptable.

Operating Experience. The staff also reviewed the OE described in LRA Section B.1.2. The applicant stated that “the Bolting Integrity Program has been effective in identification of conditions and program deficiencies and to ensure future integrity of the bolted connections.” To verify the accuracy of this statement, the staff reviewed a sample of condition reports and interviewed the applicant’s technical staff to confirm that the plant-specific OE did not reveal any degradation not bounded by industry experience. A condition report indicated that in 2002, an increase in steam leakage from the moisture separator manways was identified. The applicant evaluated the increase to have been a result of a nonconformance between new gaskets and the bolting lubricant used. As a result, affected gaskets were replaced and procedures were updated to ensure the lubricant was not used with this gasket. The staff found that proper corrective actions were taken to address the issue, including inspections on the pump as proper followup. This report and others like it confirmed the applicant’s statement above, and demonstrated that proper corrective actions are taken to address bolting issues.

The staff confirmed that the “operating experience” program element satisfies the criteria defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

USAR Supplement. In LRA Section A.1.1.2, the applicant provided the USAR supplement for the Bolting Integrity Program. The staff reviewed this section and finds it acceptable because it is consistent with the corresponding program description in SRP-LR Table 3.1-2.

The staff determines that the information in the USAR supplement is an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

The applicant committed to implement the enhancements described above to this existing program before entering the period of extended operation. This is documented in applicant commitment No. NLS2008071-02, by letter dated September 24, 2008.

Conclusion. On the basis of its audit and review of the applicant’s Bolting Integrity Program, including the applicant’s responses to the RAIs discussed above, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff has reviewed the enhancements and confirmed that their implementation, through commitment No. NLS2008071-02, prior to the period of extended operation, would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions of these components will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

3.0.3.2.2 Boiling-Water Reactor Feedwater Nozzle Program

Summary of Technical Information in the Application. LRA Section B.1.5 describes the existing BWR Feedwater (FW) Nozzle Program as consistent, with one exception with GALL AMP XI.M5, "BWR Feedwater Nozzle." The applicant indicated that this program includes inspection and flaw evaluation pursuant to the recommendations of the General Electric (GE) report GENE-523-A71-0594-A and in accordance with ASME Code, Section XI. The applicant also indicated that, under this program, CNS has removed FW nozzle cladding and installed a double piston ring and triple thermal sleeve sparger to mitigate cracking. The applicant further indicated one exception, where low flow modification of the FW control system and rerouting of the reactor water cleanup (RWCU) system was not performed.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The staff reviewed the exception to determine whether or not the exception included in the AMP is adequate to manage the aging effects as indicated in the LRA.

In comparing the elements in the applicant's program to those in GALL AMP XI.M5, the staff determined that those program elements, for which the applicant claimed consistency with the GALL Report, were consistent. The staff reviewed the applicant's report CNS-RPT-07-LRD02, "CNS License Renewal Project, Aging Management Program Evaluation Report Class 1 Mechanical, BWR Feedwater Nozzle," and found that the applicant's implementation of the BWR FW Nozzle Program is consistent with GALL AMP XI.M5. The staff noted that the applicant complied with the inspection requirements specified in ASME Code, Section XI and GENE-523-A71-0594-A report, and found these requirements consistent with GALL AMP XI.M5. Based on its review, the staff finds that the applicant's BWR FW Nozzle Program is consistent with the GALL Report AMP and, therefore, is acceptable.

Exception. LRA Section B.1.5 states an exception to the "preventive actions" program element in that the applicant elected not to perform the GALL Report recommended low-flow modifications of the FW control system and routing of the RWCU system as recommended in NUREG-0619. NUREG-0619, Section 4.4.1.2.2 permits each applicant, based on its evaluation, not to perform low flow modification of the FW control systems; and, CNS opted not to perform this modification. CNS's implementation of the inspection program in accordance with the recommendations of the staff-approved GENE-523-A71-0594-A report and the requirements of the ASME Code, Section XI confirmed that the applicant is in compliance with the GALL AMP XI.M5, and that the exception taken by CNS did not affect the aging degradation of the FW nozzle. Since the 2005 outage, inspections of FW nozzles N4A, N4B, N4C, and N4D did not reveal any indications that required evaluations; therefore, the staff concludes that the results provide assurance that the applicant's BWR FW Nozzle Program is acceptable. By complying with inspection guidelines specified in the GENE-523-A71-0594-A report and the ASME Code, Section XI, the aging degradation of the FW nozzle can be effectively managed by the applicant during the period of extended operation. Therefore, the staff finds the program exception acceptable.

Operating Experience. The staff reviewed the OE provided in LRA Section B.1.5 and also interviewed the applicant's technical staff to confirm that the plant-specific and industry OE did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific OE have been reviewed by the applicant and are evaluated in the GALL Report. The staff also reviewed the description of the applicant's OE report during the audit in which the applicant provided the inspections, frequency of inspections, and various corrective actions taken for the FW nozzles. The staff reviewed the inspection results that were performed thus far, and noted that the applicant did not find any indications that required evaluations. Therefore, the staff concludes that by complying with inspection guidelines specified in relevant sections of the GENE-523-A71-0594-A report and by complying with the ASME Code, Section XI requirements, the applicant demonstrated that it is capable of effectively managing the aging degradation of the FW nozzles during the period of extended operation.

The staff confirmed that the "operating experience" program element satisfies the criteria defined in the GALL Report and SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

USAR Supplement. In LRA Section A.1.1.5, the applicant provided the USAR supplement for the BWR FW Nozzle Program. The staff reviewed this section and found that the applicant has committed to comply with the recommendations of the GENE-523-A71-0594-A report and the requirements of the ASME Code, Section XI for aging management of the FW nozzles. Hence, the applicant is consistent with the GALL AMP XI.M5 and, therefore, the USAR supplement for the BWR FW Nozzle Program is acceptable. The staff determines that the information in the USAR supplement is an adequate summary description of the program in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's BWR FW Nozzle 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 determines that the AMP, including the exception, is adequate to manage the aging effects as indicated in the LRA. The staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

3.0.3.2.3 Boiling-Water Reactor Stress-Corrosion Cracking Program

Summary of Technical Information in the Application. LRA Section B.1.7 describes the BWR SCC Program as an existing program that is consistent with the program elements in GALL AMP XI.M7, "BWR Stress-Corrosion Cracking" with an exception. The applicant indicated that this program includes preventive measures to mitigate IGSCC in reactor coolant pressure boundary (RCPB) components made of stainless steel, CASS or nickel alloy. The applicant also stated that the program includes inspections and flaw evaluations to monitor IGSCC and its effects on the components.

Staff Evaluation. In its audit and review, the staff reviewed the applicant's on-site documentation supporting the applicant's conclusion that the program elements are consistent with the elements in the GALL Report AMP except in the areas further described below. The staff reviewed the exception to determine whether or not the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. The staff also interviewed the applicant's technical staff and reviewed the LRA and relevant documents such as the ASME Code Section XI ISI results, Technical Specifications and USAR. In comparing the elements in the applicant's program to those in GALL AMP XI.M7, the staff determined that those program elements, for which the applicant claimed consistency, are consistent with the GALL Report except for the areas further described below. The staff found that the following items needed to be further evaluated by issuing RAIs to the applicant.

In its review, the staff found that the ASME Code Section XI, 2001 Edition 2003 Addenda was used for the program elements, "acceptance criteria" and "corrective actions", of the applicant's program rather than the ASME Code Section XI, 1986 Edition, as recommended by the GALL Report. Therefore, the staff issued RAI B.1.7.4 by letter dated May 1, 2009, requesting that the applicant provide the justification for the program's use of the different edition and addenda of the ASME Code Section XI. By letter dated June 15, 2009, the applicant responded to the RAI and the applicant stated that NUREG-0313, Revision 2, Section 4.1 established the basis for using the 1986 Code edition rather than the earlier versions. The applicant also referred to the following excerpt from NUREG-0313, Revision 2, Section 4.1:

> In IWB 3641, the Code (Winter 83 Addenda) provided simple tables of allowable crack depth as a function of the primary stress level and crack length…. It was recognized that these tables did not provide an acceptable level of margin against failure for low toughness materials such as fluxed welds…. This problem has now been addressed by the Code and the 1986 Edition provided appropriate criteria for all types of welds.

In addition, the applicant stated that the correction provided in the 1986 edition has been maintained in subsequent editions of the Code and, consequently, the use of the ASME Code Section XI, 2001 Edition, 2003 Addenda for flaw evaluations is consistent with the requirements of GL 88-01, NUREG-0313, and NUREG-1801, XI.M7.

In its review and teleconference communication with the applicant held on July 7, 2009, the NRC confirmed that the applicant's nomenclature, "ASME Code Section XI, 2001 Edition, Addenda 2003," means the ASME Code Section XI, Edition 2001 with the addenda through 2003.

In its review, the staff finds that the ASME Code Section XI, 2001 Edition with the addenda through 2003 has been approved for the fourth 10-year ASME ISI interval of the applicant, which was started in March 2006, by the staff in accordance with 10 CFR 50.55(a). The staff also determined that the ASME Code edition and addenda provide adequate acceptance criteria for flaw evaluations and guidelines for repair and replacement activities. Consistently, the staff finds that the ASME Code Section XI, 2001 Edition with the addenda through 2003 is one of the technical references for GALL AMP XI.M7, "BWR Stress-Corrosion Cracking," and GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD." On the basis of its foregoing review, the staff determined that the edition and addenda of the ASME Code Section XI that the applicant uses for the BWR SCC Program are acceptable and adequate to manage the aging effect of SCC for the components in the program scope in accordance with 10 CFR 50.55a.

In relation to the program element “scope of program,” the staff also noted that LRA Table 3.1.2-3 for the components in the RCPB addressed AMR items of non-Class 1 flow element, instrument line snubber, piping and fittings, and tubing and valve body made of stainless steel that are subject to SCC in a treated water (greater than 140 °F) environment. The applicant indicated that the AMR items are related to LRA Table 1, item 3.2.1-8. The LRA table also indicated that the non-Class 1 components are less than 4 inches NPS and are not the part of the pressure boundary as described by Plant-Specific Note 105.

Although the applicant indicated that the components are less than 4 inches NPS, the staff was concerned that if the BWR SCC Program is not credited for non-Class 1 components with a nominal diameter of 4 inches or larger, the aging management approach might not be consistent with the program scope of GALL AMP XI.M7, especially considering that the recommendations of GL 88-01 and BWRVIP-75-A apply to the relevant components regardless of the ASME Code classification, including non-Class 1 components as stated in the GALL Report.

In addition, the staff noted that LRA Section B.1.7 stated that the BWR SCC Program manages SCC and its effect on the RCPB components and LRA Section 2.3.1.3 also stated that the major components of the RCPB include the reactor vessel (RV), recirculation loops, and the Class 1 portions of various systems connected to the RV. In its review, the staff noted that the applicant’s statements in the LRA suggested that the applicant’s BWR SCC Program mainly manages SCC and its effect for Class 1 components.

Therefore, the staff issued RAI B.1.7-6 by letter dated June 29, 2009, requesting that the applicant clarify whether or not the applicant’s program manages SCC and its effect on non-Class 1 components as well as Class 1 components, and to clarify whether or not the applicant has non-Class 1 components that are subject to the scope of the GALL AMP XI.M7, “BWR Stress Corrosion Cracking” in conjunction with GL 88-01. As part of its review of the applicant’s AMR results, the staff also issued RAI B.1.7-3 by letter dated May 1, 2009, requesting that the applicant clarify what portions of the ESFs and auxiliary systems are managed by the BWR SCC Program. The staff noted that RAI B.1.7-3 is related to the foregoing concern about the program scope. The applicant responded to RAIs B.1.7-3 and B.1.7-6 by letters dated June 15, 2009, and July 29, 2009, respectively.

In its response to RAI B.1.7-3, the applicant stated that for systems that operate intermittently, the license renewal AMR process conservatively selects the limiting environment for the determination of aging effects. The applicant also stated that for example, portions of the RHR system, which is in standby at ambient temperature during normal operation, will be exposed to temperatures greater than 140 °F when the system operates during shutdowns; so treated water greater than 140 °F is the environment evaluated. The applicant further stated that, as stated in NUREG-1801, the BWR SCC Program includes all BWR austenitic stainless steel piping that is 4 inches or larger in nominal diameter and that contains reactor coolant at a temperature above 200 °F during power operation regardless of ASME Code classification. In addition, the applicant stated that since most RHR, HPCI, and RCIC components are normally in standby at ambient temperatures (less than 200 °F), they are not included in the program. The applicant stated that the portions of the ESFs and auxiliary systems exposed to reactor coolant at temperatures greater than 200 °F during power operation are Class 1 components evaluated as part of the reactor coolant pressure boundary.

In its response to RAI B.1.7-6, the applicant stated that SCC in non-Class 1 components is not managed by the BWR SCC Program. The applicant also stated that other programs, such as the Water Chemistry Control – BWR Program, along with the One-Time Inspection Program to verify the chemistry program effectiveness, manage SCC for non-Class 1 components.

In its responses, the applicant clarified that the applicant has no non-Class 1 components within the program scope and most RHR, HPCI and RCIC components are normally in standby at ambient temperatures (less than 200 °F) such that the components are not in the scope of the BWR SCC Program. The applicant also confirmed that the SCC in the non-Class 1 components is managed by other programs such as the Water Chemistry Control – BWR Program along with the One-Time Inspection Program. Therefore, the applicant's responses to the RAIs resolved the concern regarding the potential omission of relevant non-Class 1 components from the program scope and the staff finds that the scope of the AMP is consistent with the GALL Report.

Exception. LRA Section B.1.7 states an exception to the program elements "detection of aging effects" and "monitoring and trending," in that the applicant indicated that NUREG-1801 recommends the use of GL 88-01 to determine the scope of welds selected for examination and CNS also bases this scope on risk informed methodology approved by NRC. The staff found that the selection of welds to inspect was based on the risk-informed inservice inspection (RI-ISI) methodology, which is documented in EPRI TR-112657. In LRA Section B.1.7, the applicant also indicated that the RI-ISI methodology creates a different inspection schedule for GL 88-01 Category A welds than that delineated in GL 88-01 and the applicant's RI-ISI methodology provides an acceptable level of quality and safety. LRA Section B.1.7 stated that in order to continue the RI-ISI methodology in subsequent intervals beyond the current fourth 10-year interval, approval must be obtained in accordance with 10 CFR 50.55a.

In its review, the staff noted that with or without modifications allowed by BWRVIP-75-A, GL 88-01 calls for a specific inspection extent and schedule for Category A welds. Therefore, the staff issued RAI B.1.7-5 by letter dated June 29, 2009, requesting the applicant confirm whether or not only Category A welds may have a different inspection extent and schedule in the applicant's program when the program is compared with GL 88-01. Also, if the RI-ISI methodology affects any other GL 88-01 IGSCC category welds in terms of inspection extent and schedule, to clarify what categories are affected by the RI-ISI methodology. In a letter dated July 29, 2009, the applicant responded to the RAI stating that:

> The extent and schedule for examination of Category A welds in the CNS RI-ISI program is consistent with the requirements of GL 88-01 and BWRVIP-75A. The extent and schedule for examination of the one Category D weld is consistent with BWRVIP-75A; once every six years.

The applicant also stated that no weld categories other than Category A are affected by the RI-ISI program. In its review of the RAI response, the staff found a need to further clarify how the RI-ISI-based inspection extent and frequency for Category A welds are compared with the requirements of GL 88-01 and BWRVIP-75-A in more detail.

In a teleconference communication held on August 6, 2009, and September 2, 2009, the applicant clarified that 25 percent of IGSCC Category A Examination Category B-F welds are inspected in the 10-year inspection interval and 10 percent of Category A Examination Category B-J welds are inspected in the 10-year inspection interval. The applicant also confirmed that the second mitigation, which allows the inspection of 10 percent B-J welds rather than 25 percent of the welds, is induction heating stress improvement in accordance with BWRVIP-75-A. In its review of the technical information the applicant provided, the staff finds that the applicant's RI-ISI methodology for the inspection of Category A and D welds is acceptable to manage the aging effect as the applicant's inspection extent and frequency are consistent with GL 88-01 and

BWRVIP-75-A as recommended in the GALL Report. Therefore, the staff determined that this exception is acceptable.

Operating Experience. The staff also reviewed the OE described in LRA Section B.1.7. The applicant indicated that the examinations during RFOs RE19 in 2000 and RE22 in 2005 revealed recordable indications on a CRD nozzle-to-cap weld, which were caused by inside diameter (ID) geometry and determined to be acceptable. The staff reviewed ISI Summary Reports NLS2000069 and NLS2005049 for RFOs RE19 and RE22, respectively, and confirmed that the indications were acceptable. In LRA Section B.1.7, the applicant also stated that in 2000 during RE19, safe end nozzles and piping components were examined using ultrasonic technology and found acceptable. The staff reviewed the relevant ISI Summary Report and confirmed that the applicant's statement in the LRA was consistent with the inspection results.

The staff confirmed that the "operating experience" program element satisfies the criteria defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

USAR Supplement. In LRA Section A.1.1.7, the applicant provided the USAR supplement for the BWR SCC Program. The staff reviewed the USAR supplement in comparison with SRP-LR Table 3.1-2 and determines that the information provided is an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's BWR SCC 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 the LRA credits it. The staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an acceptable summary description of the program in accordance with 10 CFR 54.21(d).

3.0.3.2.4 Boiling-Water Reactor Vessel Internals Program

Summary of Technical Information in the Application. The applicant provided the following description of the BWR Vessel Internals Program. In the LRA, the applicant included Appendix C, "Response to BWRVIP Application Action Items Cooper Nuclear Station," which addresses the staff's license renewal action items for various BWRVIP reports.

LRA Section B.1.9 describes the existing BWR Vessel Internals Program as consistent, with enhancements, with the GALL AMP XI.M9, "BWR Vessel Internals." The applicant indicated that this program includes inspection, flaw evaluation and repair guidelines that are consistent with the guidelines addressed in relevant BWRVIP reports. The applicant further stated that water chemistry guidelines per the BWRVIP-130 report, "Water Chemistry," will be complied with to ensure the integrity of the reactor vessel internals (RVIs) components. To ensure the integrity of the steam dryer components, the applicant invoked the inspection requirements specified in the BWRVIP-139 report, "BWR Vessel and Internals Project Steam Dryer Inspection and Flaw Evaluation Guidelines," at CNS. The applicant indicated that the BWR Vessel Internals Program is consistent with the GALL AMP XI.M9 for the RVIs. The applicant did not take any exception to GALL AMP XI.M9, but implemented an enhancement to GALL AMP XI.M9. This enhancement would entail replacement of the plugs in core plate bypass holes based on their structural integrity (Commitment No. NLS2008071-4).

The applicant provided information with respect to plant-specific OE in which it stated that inspections were performed on CS piping, spargers, brackets, top guide pin keepers, top guide aligner pins, and steam dryer lifting lugs. The applicant further stated that it evaluated the indications that were found thus far in these RVI components and accepted them per the applicable BWRVIP inspection guidelines. The applicant reiterated that it complied with the inspections and flaw evaluation guidelines specified in the applicable BWRVIP reports and it would continue to implement these guidelines to ensure the structural integrity and functionality of these components during the period of extended operation.

LRA Appendix C lists the following BWRVIP reports which would be implemented by the applicant during the period of extended operation:

- BWRVIP-18-A, “BWR Core Spray Inspection and Flaw Guidelines”
- BWRVIP-25, “BWR Core Plate Inspection and Flaw Evaluation Guidelines”
- BWRVIP-26-A, “BWR Top guide Inspection and Flaw Evaluation Guidelines”
- BWRVIP-27-A, “BWRVIP Standby Liquid Control System/Core Spray/ Core Plate P Inspection and Flaw Evaluation Guidelines”
- BWRVIP-38, “BWR Shroud Support Inspection and Flaw Evaluation Guidelines”
- BWRVIP-41, “BWR Vessel and Internals Project, Jet Pump Assembly, Inspection and Flaw Evaluation”
- BWRVIP-47-A, “BWR Lower Plenum Inspection and Flaw Evaluation Guidelines”
- BWRVIP-48-A, “Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines”
- BWRVIP-49-A, “Instrument Penetration Inspection and Flaw Evaluation Guidelines”
- BWRVIP-74-A, “BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines”
- BWRVIP-76, “BWR Core Shroud Inspection and Flaw Evaluation Guidelines”
- BWRVIP-116, “BWR Vessel and Internals Project Integrated Surveillance Program”

In LRA Appendix C, the applicant included three license renewal action items that are applicable to all BWRVIP reports and several other license renewal action items that are applicable to specific BWRVIP reports. In addition, LRA Appendix C addresses the applicant’s response to other license renewal action items. The staff included the license renewal action items, the applicant’s response, and its evaluation in the staff evaluation section for this AMP.

<u>Staff Evaluation</u>. The staff reviewed the documents provided by the applicant, and found that the applicant’s implementation of the BWRVIP reports is consistent with the GALL AMP XI.M9.

The applicant routinely inspected the RVI components per the applicable BWRVIP reports, and repaired and/or evaluated the indications in accordance with the BWRVIP reports or ASME Code, Section XI. The staff noted that the applicant's program relies on monitoring and control of RWC based on the guidance of BWRVIP-130 report (EPRI-008192), which is a later revision to the BWRVIP-29 report and the staff finds it acceptable because the GALL Report allows the use of a later revision of the BWRVIP report for monitoring the RCS water chemistry. During the audit, the staff found that the applicant is using HWC in conjunction with NMCA to mitigate IGSCC. The applicant's methodology of monitoring the effectiveness of HWC/NMCA includes measuring the electrochemical potential (ECP) of the RVI components in RCS water and monitoring the FW hydrogen level. These methods will ensure adequate protection of the majority of the RVI components for IGSCC.

With respect to the plant-specific OE portion of this AMP, during the staff audit, the applicant provided several inspection reports associated with the previous inspections that were performed on the RVI components. The staff reviewed the inspection reports and concluded that the applicant complied with the inspection requirements of the applicable BWRVIP reports which are consistent with the GALL Report AMP. The staff also reviewed the applicant's implementation of its corrective action methodology for identifying non-conforming conditions and found the applicant's corrective action methodology acceptable. The staff, therefore, concludes that the applicant adequately implemented the inspection criteria of the BWRVIP reports for the RVI components and that the AMP is consistent with the GALL AMP XI.M9. Based on the review of plant-specific OE, the staff concludes that by implementing the BWR Vessel Internals Program the applicant adequately demonstrated its capability in identifying the aging effects associated with the RVI components. The applicant also demonstrated that it can adequately monitor the aging degradation of the RVI components by using proper corrective actions to restore the structural integrity of the RVI components.

Regarding the enhancement to AMP XI.M9, the staff reviewed the applicant's proposal for the replacement of the plugs in core plate bypass holes as a part of TLAA and the staff's review is addressed in the TLAA Section 4.7 of the SER. During the staff audit, the staff identified two issues related to the core shroud component and one issue related to the top guide component that required clarification. These three issues are: (1) reduced fracture toughness for core shroud materials exposed to high levels of neutron fluence, (2) fatigue/cyclic or crack growth analysis that is necessary for the core shroud component, and (3) augmented inspections for the top guide grid beams.

The staff issued three RAIs dated May 1, 2009, which are described below:

RAI B.1.9-1. Top guide grid beams are one of the reactor vessel internal (RVI) components that are susceptible to irradiation assisted stress-corrosion cracking (IASCC) when exposed to a neutron fluence (neutron flux integrated over time) value greater than 5×10^{20} neutrons per square centimeter (n/cm^2) (E greater than 1 million electron volts (MeV)). GALL Report Table IV B1-17 states that 5 percent of these top guide locations that are exposed to a fluence value greater than the aforementioned threshold value will be inspected using EVT-1 within six years after entering the period of extended operation. An additional 5 percent of these top guide locations will be inspected within 12 years after entering the period of extended operation. Contrary to this guidance in the GALL Report, the applicant, in LRA Appendix C stated that it will comply with the inspection requirements specified in the BWRVIP-26 report which does not include the GALL Report's inspection guidelines for the top guide components. The applicant was requested to clarify the inspection approach, method, frequency, and acceptance criteria that will be implemented for top guide grid beams.

In its letter dated June 15, 2009, the applicant indicated that it would implement the inspection criteria specified in the BWRVIP-183 report, "Top Guide Grid Beam Inspection and Flaw Evaluation Guidelines," which are consistent with the inspection requirements specified in GALL Report Table IV B1-17. Even though the BWRVIP-183 report is currently being reviewed by the staff, the staff determined that the applicant can continue adopting the BWRVIP-183 inspection guidelines at CNS because these inspection guidelines are consistent with GALL Report requirements. Therefore, the staff accepts the applicant's response and considers that the issue related to RAI B.1.9-1 is closed.

RAI B.1.9-2. Reduction in ductility and fracture toughness can occur in stainless steel (reactor vessel internal) RVI components when they are exposed to high-energy neutrons (E greater than 1 MeV). In August 2006, the BWRVIP issued a staff-approved BWRVIP-100-A report, "Updated Assessment of the Fracture Toughness of Irradiated Stainless Steel for BWR Core Shrouds," which discusses fracture toughness results for the irradiated stainless steel materials. For stainless steel materials exposed to neutron fluence equal to or greater than 1 X 10^{21} n/cm^2 (E greater than 1 MeV), the BWRVIP-100-A report identified lower fracture toughness value than the value reported in Appendix C of the BWRVIP-76 report, "BWR Vessel and Internals Project BWR Core Shroud Inspection and Flaw Evaluation Guidelines." During the period of extended operation, core shroud welds and base materials may be exposed to neutron fluence values of 1 X 10^{21} n/cm^2 (E greater than 1 MeV) or greater. The GALL AMP XI.M9 recommends that the flaw evaluation guidelines of the BWRVIP-76 be applied for cracked core shroud components.

In a letter dated May 1, 2009, the staff requested that the applicant make a commitment to incorporate the crack growth rate evaluations specified in the BWRVIP-100-A report and develop generic inspection intervals for core shroud welds that are exposed to neutron fluence equal to or greater than 1 X 10^{21} n/cm^2 (E greater than 1 MeV). Also, the staff requested that the applicant provide the basis for using the non-conservative fracture toughness values of BWRVIP-76 instead of the values identified in BWRVIP-100-A report.

In its letter dated June 15, 2009, the applicant indicated that the BWRVIP-100-A requirements have been implemented at CNS and that it has been using conservative fracture toughness values documented in the BWRVIP-100-A report for the fracture mechanics evaluation for the core shroud component. The staff accepts this response because application of conservative fracture toughness values that are approved by the staff for the flaw evaluation of the core shroud component provides adequate assurance in maintaining the structural integrity of the core shroud components that are exposed to neutron fluence equal to or greater than 1 X 10^{21} n/cm^2 (E greater than 1 MeV). The staff considers that the issue related to RAI B.1.9-2 is resolved.

RAI B.1.9-3. The GALL Report AMR item IV B1-14 indicates that cumulative fatigue evaluation is a TLAA for core shroud components. In a letter dated May 1, 2009, the staff requested that the applicant describe the details of any fatigue/cyclic or crack growth analysis that was performed for the core shroud. The applicant was asked to identify whether or not that analysis is a TLAA, and demonstrate how the requirements of 10 CFR 54.21(c)(1) are met. In its letter dated June 15, 2009, the applicant indicated that the core shroud component is not a pressure boundary ASME Code item and the original design basis did not include a fatigue analysis. Therefore, the applicant determined not to perform TLAA analysis for the core shroud component. However, the applicant reiterated that it would continue to comply with the requirements of the BWRVIP-76 report in which periodic inspections in conjunction with the application of proper flaw evaluation methodology would be implemented for the cracked core shroud components. The staff accepts this response because: (1) no fatigue evaluation of the core shroud component is performed under the current license, and (2) the aging effect due to fatigue is properly managed by implementing the inspection requirements specified in the BWRVIP-76 report including the flaw evaluation methodology for the cracked core shroud components. Therefore, the staff considers that the issue related to RAI B.1.9-3 is resolved.

Based on its review, including the applicant's response to the RAIs, the staff finds that the BWR Vessel Internals Program is in accordance with the GALL AMP XI.M9, and therefore, the staff finds this AMP acceptable.

The applicant is required to comply with the license renewal action items specified in the staff's SERs for the aforementioned BWRVIP reports for the period of extended operation. The following paragraphs address the applicant's responses to these license renewal action items and the corresponding staff's evaluation.

<u>License Renewal Action Items Addressed in Appendix C</u>. The applicant made a commitment to comply with the following three license renewal action items which are listed in staff's SER for the various BWRVIP reports:

- BWRVIP reports (CNS's AMP for the RVI components is bounded by these)
- USAR supplement (addresses a summary of the programs and activities specified in the applicable BWRVIP reports)
- AMP for the RVI components (CNS states that no technical specification changes have been identified as a result of implementing these).

The staff reviewed the applicant's disposition for these three license renewal action items and concluded that the applicant complied with the intent of the license renewal action items that were specified by the staff in its SERs for the applicable BWRVIP reports.

According to the applicant there are no TLAA issues for CNS related to the following BWRVIP reports, but it has committed to complying with the requirements specified in these BWRVIP reports:

(1) BWRVIP-18-A, "BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines"

(2) BWRVIP-26-A, "BWR Top Guide Inspection and Flaw Evaluation Guidelines"

(3) BWRVIP-27-A, "BWR Standby Liquid Control System/Core Plate ΔP Inspection and Flaw Evaluation Guidelines"

(4) BWRVIP-47-A, "BWR Lower Plenum Inspection and Flaw Evaluation Guidelines"

The staff reviewed the applicant's response to the license renewal action items and accepted it because the staff's SERs for the aforementioned BWRVIP reports do not specify any license renewal action items.

Regarding the implementation of the BWRVIP-25 report inspection requirements, the applicant indicated that the aging effect due to irradiation induced stress relaxation on core plate hold down bolts is managed by performing an analysis which showed that the preload clamping condition of the core plate hold down bolts is not critical to seismic integrity. In this context, the staff, in RAI 4.1-1, by letter dated July 14, 2009, requested that the applicant perform a TLAA analysis related to irradiation induced stress relaxation of the core plate hold down bolts and submit this analysis to the staff for review and approval prior to entering into the license renewal period (this is consistent with the staff's safety evaluation (SE) for the BWRVIP-25 report). Since core plate wedges are not installed at CNS, consistent with the inspection requirements specified in item 10 of Table 3-2 of the BWRVIP-25 report, the applicant is required to continue enhanced visual inspection (EVT-1) of the core plate hold down bolts. Therefore, the staff requested that the applicant confirms that it will continue performing EVT-1 of the core plate hold down bolts and use UT from a location above the core plate when the UT technique is developed by the industry.

In its letter dated August 13, 2009, the applicant indicated that it did not consider performing a TLAA analysis for the core plate hold down bolts because the existing analysis is not a 40-year analysis. The applicant indicated that it would continue to perform inspections of the core plate hold down bolts per the BWRVIP-25 report. The applicant further stated that it would use EVT-1 from below the core plate or UT from above the core plate when an approved method is developed by the industry.

A plant-specific analysis for the core plate hold down bolts was developed by GE in GE Report GENE-0000-0004-4888-01, Revision 0, "Assessment of the Structural Integrity of Core Plate Rim Bolts." During a conference call with the applicant on December 2, 2009, the staff requested that the applicant submit the GE report (at least two years prior to the period of extended operation) for the staff's review and approval. In its RAI response letter dated December 21, 2009, the applicant committed to providing a non-proprietary version (or a redacted version per 10 CFR 2.390) of an analysis of the core plate rim bolts at least two years prior to the period of extended operation. However, the staff determined that a proprietary version of the GE report is needed for its review, as a part of a submittal for the staff's review of an analysis of the core plate rim bolts, at least two years prior to the period of extended operation. By letter dated March 25, 2010, the applicant provided commitment NLS2009100-1 (Revision 1) to provide (or otherwise make available for NRC review and approval) a complete propriety version of the GE report,

The license renewal action items specified in the staff's SER dated October 18, 2001, for the BWRVIP-74-A report, address the aging effects on the RVI components and this report provides requirements to effectively manage the aging effects during the period of extended operation. The BWRVIP-74-A report also addresses the license renewal action items associated with TLAAs for the period of extended operation. The following paragraphs address the TLAAs and the AMP related to RVI components that are specified in the BWRVIP-74-A report, the applicant's responses to these license renewal action items, and the corresponding staff's evaluation of each item.

Per item 4 of the license renewal action item in the staff's SE for the BWRVIP-74 report, the applicant identified that loss of material and cracking as aging effects that require an AMP for the vessel flange leak detection (VFLD) line. The applicant indicated that it would manage these aging effects by performing a one-time inspection and an ISI program in accordance with the ASME Code, Section XI, and by controlling the RCS water chemistry. The staff accepts the applicant's proposed AMP for the VFLD lines because: (1) combination of ISI and one-time inspection programs will adequately identify the aging degradation in a timely manner; and (2) controlling water chemistry will also enable the applicant to effectively manage the occurrence of any cracking or loss of material in VFLD lines.

Item 5 of the license renewal action items in the staff's SE for the BWRVIP-74 report requires that the applicant describe how each plant-specific AMP addresses the 10 elements listed in GALL AMP XI.M9. The applicant indicated that Appendix B of the LRA addresses the required 10 elements. The staff reviewed Appendix B and accepts the applicant's response because Appendix B adequately addresses the 10 elements of the GALL Report AMP.

Item 6 of the license renewal action items in the staff's SE for the BWRVIP-74 report requires that the applicant shall include a water chemistry program in its LRA to ensure that it can effectively manage IGSCC in the RCS systems. In its response, the applicant stated that it would comply with the BWRVIP-130 report which superseded the BWRVIP-29 report. The staff accepts this response in accordance with BWRVIP-130 as it provides adequate mitigation to the occurrence of IGSCC.

Item 7 of the license renewal action items in the staff's SE for the BWRVIP-74 report requires that the applicant identify its Reactor Vessel Surveillance Program. The applicant indicated that it has implemented the staff approved BWRVIP integrated surveillance program (ISP) – BWRVIP-116, "BWR Vessel and Internals Project Integrated Surveillance Program." Compliance with the staff approved ISP enables the applicant to effectively monitor neutron embrittlement of the RPV materials and, therefore, the staff accepts the applicant's response.

Item 8 of the license renewal action items in the staff's SE for the BWRVIP-74 report requires that the applicant verify that the number of cycles assumed in the original fatigue design is conservative to assure that the estimated fatigue usage for 60 years of plant operation is not underestimated. The use of alternative actions for cases where the estimated fatigue usage is projected to exceed 1.0 will require case-by-case analysis. The applicant should address environmental fatigue for the components listed in the BWRVIP-74 report. The applicant indicated that fatigue (including discussions of cycles, projected cumulative usage factors (CUFs), and environmental factors, etc.) is evaluated as a TLAA in Section 4.3 of the LRA. The staff's evaluation on this issue is addressed in this SER Section 4.3.

Item 9 of the license renewal action items in the staff's SE for the BWRVIP-74 report requires that a set of pressure temperature (P-T) curves be developed for the heat-up and cool-down operating conditions in the plant at a given effective full-power year (EFPY) during the license renewal period. The applicant indicated that the development of P-T curves for the period of extended operation is described as a TLAA in Section 4.2.3 of the LRA. The staff evaluated the TLAA associated with P-T curves in this SER Section 4.2.

Item 10 of the license renewal action items in the staff's SE for the BWRVIP-74 report requires that the applicant evaluate the percent of reduction in charpy upper-shelf energy (USE) values for the belt line materials during the extended period of operation. The applicant indicated that the TLAA evaluation of USE is addressed in Section 4.2.4 of the LRA. The staff evaluated the TLAA associated with the USE criteria for the RPV beltline materials in this SER Section 4.2.4.

Item 11 of the license renewal action items in the staff's SE for the BWRVIP-74 report requires that the applicant obtain relief from the ISI of the circumferential shell welds during the license renewal period. The BWRVIP-05 report, "Reactor Vessel Shell Weld Inspection Guidelines," requires that each applicant will have to demonstrate that (1) at the end of the renewal period, the circumferential shell welds will satisfy the limiting conditional failure frequency specified in Appendix E for the staff's SER dated July 28, 1998, for the BWRVIP-05 report, and (2) that it has implemented operator training and established procedures that limit the frequency of cold over-pressure events to the amount specified in the staff's SER dated July 28, 1998, for the BWRVIP-05 report. The applicant indicated that the discussion of the relief from the ISI of the circumferential shell welds for CNS during the period of extended operation is described in Section 4.2.5 of the LRA. The staff evaluated the TLAA associated with the relief from the ISI of the RPV circumferential shell welds for CNS and the staff's evaluation is addressed in this SER Section 4.2.5.

Item 12 of the license renewal action items in the staff's SE for the BWRVIP-74 report requires that the applicant monitor RPV axial beltline weld embrittlement. One acceptable method is to determine that the mean reference nil-ductility transition temperature (RT_{NDT}) of the limiting RPV axial beltline weld at the end of the period of extended operation is less than the values specified in Table 1 of the staff's SER dated October 18, 2001, for the BWRVIP-74-A report. The applicant indicated that the TLAA evaluation of beltline axial weld is addressed in Section 4.2.5 of the LRA. The staff evaluated the TLAA associated with the RPV axial weld failure probability for CNS in this SER Section 4.2.5.

Item 13 of the license renewal action items in the staff's SE for the BWRVIP-74 report requires that the charpy USE, P-T limit, inspection relief for the RPV circumferential shell welds, and RPV axial weld integrity evaluations are all dependent upon the neutron fluence. The applicant may perform neutron fluence calculations using a staff-approved methodology or may submit its methodology for staff review. If the applicant performs the neutron fluence calculation using a methodology previously approved by the staff, the applicant should identify the staff letter that approved the methodology. The applicant indicated that the calculation of neutron flux is addressed in Section 4.2.1 of the LRA. The staff evaluated the TLAAs associated with the neutron fluence calculations in this SER Section 4.2.1.

Item 14 of the license renewal action items in the staff's SE for the BWRVIP-74 report requires that the components that have indications which were previously evaluated analytically in accordance with subsection IWB-3600 of the ASME Code, Section XI until the end of the 40-year service period shall be re-evaluated for the 60-year service period corresponding to the period of extended operation. The applicant indicated that it has performed flaw evaluations for previously identified indications and they are discussed in Section 4.3 of the LRA. The staff evaluated the TLAAs associated with the flaw evaluations in this SER Section 4.3

<u>USAR Supplement</u>. In LRA Section A.1.1.9, the applicant provided the USAR supplement for the BWR Vessel Internals Program. The staff reviewed this section and determined that the information in the USAR supplement provided an adequate summary description of the program (in which the applicant made a commitment to incorporate the BWRVIP inspection requirements for the RVI components), in accordance with 10 CFR 54.21(d).

<u>Conclusion</u>. On the basis of its review of the applicant's BWR Vessel Internals Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the enhancements and confirmed that the implementation of the enhancements prior to the period of extended operation would result in the existing AMP being consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant had 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, in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it provides an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

3.0.3.2.5 Reactor Vessel Surveillance Program

Summary of Technical Information in the Application. LRA Section B.1.33 covers the Reactor Vessel Surveillance Program. CNS uses the ISP to monitor the effects of neutron embrittlement in the RPV beltline materials. The program satisfies the requirements of 10 CFR Part 50, Appendix H, "Reactor Vessel Material Surveillance Program Requirements." The Reactor Vessel Surveillance Program is based upon the BWRVIP-78 "BWR Integrated Surveillance Program Plan," and the BWRVIP-86-A, "BWR Vessel and Internals Project, BWR Integrated Surveillance Program Implementation," reports.

The BWRVIP-116 report, "BWR Vessel Internals Project Integrated Surveillance Program Implementation for License Renewal," identifies and schedules additional capsules to be withdrawn and tested during the license renewal period. CNS will continue to participate in the ISP during the period of extended operation by implementing the requirements of the BWRVIP-116 report (including the withdrawal of extra capsules and contingency plans for unforeseen events). Again, this revised ISP is consistent with 10 CFR Part 50, Appendix H and will give reasonable assurance that the fracture toughness requirements of 10 CFR Part 50, Appendix G will be met through the period of extended operation.

The Reactor Vessel Surveillance Program is an existing program, and it is consistent with AMP XI.M31, "Reactor Vessel Surveillance," as specified in the GALL Report. No exceptions are taken by the applicant. As an enhancement to the GALL Report AMP, the applicant is determined to implement the following two monitoring and trending enhancements prior to the period of extended operation. First, if the CNS standby capsule is removed from the RPV without the intent of testing it, the capsule will be stored in a manner that maintains the capsule in a condition which would permit its future use, including during the period of extended operation if necessary. The second enhancement will ensure that the additional requirements that are specified in the final staff SE for the BWRVIP-116 report will be addressed before the period of extended operation.

As part of the BWRVIP ISP, CNS withdrew Supplemental Surveillance Program capsules A, B, and C for testing in 2003, and updated the fluence calculation for the CNS RPV. The three capsules did not include the limiting materials for CNS, but the results from testing these capsules affected other plants. The updated fluence calculation did result in a change in the technical specifications (P-T curves), approved on April 27, 2006. In conclusion, the applicant indicated that the implementation of the RPV ISP assures that aging effects from neutron embrittlement will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the CLB through the period of extended operation.

Staff Evaluation. In LRA Appendix B, Reactor Vessel Surveillance Program, the applicant described its AMP for monitoring irradiation embrittlement of the RPV through testing that monitors the properties of the beltline materials. The LRA included two enhancements to the GALL AMP XI.M31. For the current period of operation, the applicant has implemented the BWRVIP ISP which is based on the BWRVIP-78 report and the BWRVIP-86-A report. These reports are consistent with the GALL Report AMP XI.M31 for the current period of operation. 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 of the compatible neutron fluence methodologies acceptable to the staff for determining surveillance capsule and RPV neutron fluences. The staff's acceptance of the BWRVIP ISP for the current term at CNS is documented in License Amendment 201 for CNS, dated October 2003.

For the license renewal period, the applicant has stated in commitment NLS2008071-23 that the enhanced program will be consistent with GALL AMP XI.M31. BWRVIP-116 provides guidelines for an ISP to monitor neutron irradiation embrittlement of the RPV beltline materials for all U.S. BWR power plants for the period of extended operation. The staff also reviewed the USAR supplement Section A.1.1.33 to determine if it provides an adequate description of the program.

On the basis of its review, the staff finds that, with enhancements to the Reactor Vessel Surveillance Program, the applicant has demonstrated that the effects of aging due to loss of fracture toughness of the RPV beltline region will be adequately managed, so that the intended functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3). The associated license condition for this enhancement is as follows:

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

USAR Supplement. The staff reviewed the applicant's proposed revision to Section A.1.1.33 of the USAR Supplement and determined that by implementing the most recent staff-approved version of the BWRVIP-116 report, the applicant is in accordance with 10 CFR Part 50, Appendix H. The staff concludes that the information provided in the USAR supplement for the aging management of systems and components discussed above is equivalent to the information in NUREG-1801 and therefore provides an adequate summary of program activities in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Reactor Vessel Surveillance Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. Also, the staff reviewed the enhancements and confirmed that the implementation of the enhancements prior to the period of extended operation would result in the existing AMP being consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it provides an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

3.0.3.2.6 Containment Inservice Inspection Program

Technical Information in the Application. LRA Section B.1.10 describes the existing Containment ISI Program as consistent, with enhancements, with GALL AMP XI.S1, "ASME Section XI, Subsection IWE." The applicant indicated that the program manages loss of material and cracking for the primary containment (PC) and its integral attachments through visual inspections for evidence of flaking, blistering, peeling, discoloration, and other signs of distress. The program is implemented in accordance with 10 CFR 50.55a and utilizes ASME Section XI, Subsection IWE, 2001 Edition through the 2003 Addenda for the current inspection interval.

<u>Staff Evaluation</u>. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The staff reviewed the enhancements to determine whether or not the AMP, with the enhancements, is adequate to manage the aging effects for which the LRA credits it.

The staff reviewed the applicant's on-site documentation supporting the applicant's conclusion that the program elements for which it claims consistency are consistent with the elements in the GALL Report. The staff also confirmed that the plant program contains all of the elements of the referenced GALL Report and that the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated. The staff conducted onsite interviews with the applicant to confirm these results.

In comparing the program elements in the applicant's program to those in the GALL AMP XI.S1, the staff noted the program elements in the applicant's claim of consistency with the GALL Report were consistent with the GALL AMP XI.S1.

<u>*Enhancement 1*</u>. LRA Section B.1.10 describes the applicant's proposed enhancement (Commitment No. NLS2009071-05) to the GALL Report "detection of aging effects" program element as follows:

> For surface areas requiring augmented examination, guidance will be provided in CNS Containment Inservice Inspection (CII) Program to require accessible areas to be examined using a visual examination method and surface areas not accessible on the side requiring augmented examination to be examined using an ultrasonic thickness measurement method in accordance with IWE-2500(b).

The staff reviewed the corresponding program element in GALL AMP XI.S1 as well as the applicable requirements in the ASME Code Section XI, 2001 Edition. The staff determined the applicant's enhancement is consistent with the recommendations in the "detection of aging effects" program element of GALL AMP XI.S1 and is consistent with the requirements of Subsection IWE, as recommended in the GALL Report. On the basis of its review, the staff finds this enhancement acceptable because when implemented prior to the period of extended operation, the program element will be consistent with the recommendations in GALL AMP XI.S1.

<u>*Enhancement 2*</u>. LRA Section B.1.10 describes the applicant's proposed enhancement (Commitment No. NLS2009071-05) to the GALL Report program element, "acceptance criteria" as follows:

> For volumetric inspections, guidance will be provided in the CNS CII Program to document material loss in a local area exceeding 10 percent of the nominal containment wall thickness or material loss in a local area projected to exceed 10 percent of the nominal containment wall thickness before the next examination in accordance with IWE-3511.3 for volumetric inspections.

The staff reviewed the corresponding program element in the GALL AMP XI.S1 as well as the applicable requirements in ASME Code Section XI, Subsection IWE, 2001 Edition. The ASME Code Section XI, IWE-3511.3 also requires local areas of degradation to be accepted by engineering evaluation or corrected in accordance with IWE-3122 and supplemental examinations to be performed in accordance with IWE-3200. It was not clear to the staff if these additional requirements of IWE 3511.3 were currently included in the applicant's program, or if the requirements would be included in the enhancement. During the audit, the staff asked the applicant for clarification concerning the enhancement. The applicant explained that the current program follows the ASME Code, Subsection IWE, including all requirements of IWE 3511.3. The enhancement is intended to clarify IWE requirements within the AMP procedures prior to the period of extended operation.

On the basis of its review, the staff finds this enhancement acceptable because when implemented as a part of Commitment 5, prior to the period of extended operation, the program element will be consistent with the recommendations in the GALL AMP XI.S1.

Operating Experience. The staff also reviewed the OE described in LRA Section B.1.10. In addition, the staff reviewed a sample of condition reports and interviewed the applicant's technical staff to confirm that the plant-specific OE did not reveal any degradation not bounded by industry experience. In the LRA, the applicant described several cases of degradation discovered during visual inspections over the last 10 years. The degradation included items such as torus pitting, general corrosion, pinpoint rusting, and tiger striping. The staff reviewed documentation which showed the degradation was evaluated and approved for service or repaired as necessary. The staff also verified that the appropriate augmented exams where conducted in accordance with the ASME code.

Past OE in Mark I steel containments, as described in LR-ISG-2006-01, has shown that loss of material due to corrosion may be significant in inaccessible sand bed regions. During the audit, the applicant informed the staff that a drywell sand bed drain vacuum test was performed on four of eight drains in 1993 to address this issue. The staff was not confident that the test results from 17 years ago demonstrated that the entire sand bed region was still free of moisture. To address this, the staff issued RAI B.1.10-1, by letter dated May 1, 2009.

In its response dated June 15, 2009, the applicant provided Commitment No. NLS2009071-05 to performing a vacuum test of all eight sand bed drain lines prior to the period of extended operation. The applicant also explained that the sand bed drain lines are inspected for signs of leakage during RFOs and OE at CNS showed no leakage.

The staff reviewed the applicant's response and found that it addressed leakage through the drywell-to-reactor building bellows; however, it did not clearly explain how CNS is addressing the possibility of leakage through the refueling cavity liner. Leakage through the liner could initiate and propagate corrosion of the drywell shell. To address this issue, the staff held conference calls with the applicant on November 9, 2009, and January 8, 2010. As a followup to the conference calls, the applicant stated that it would visually inspect the refueling cavity liner at intervals of no greater than five years. This resolves the staff's concern because small leaks through the refueling cavity liner will result in staining or discoloration of the liner, which would be detectable via the visual inspections.

Because the LRA does not credit GALL AMP XI.S8, "Protective Coating Monitoring and Maintenance Program," for managing the effects of aging on the torus shell, the staff asked RAI B.1.10-5, dated September 28, 2009, which requested that the applicant provide details of the proposed CNS CII Program and the service level I coating program to provide adequate assurance that there is proper maintenance of the protective coatings in containment, such that they will not degrade and become a debris source that may challenge the emergency core cooling system (ECCS).

The applicant responded to the RAI B.1.10-5 in a letter dated October 22, 2009. In the response, the applicant stated that the CII Program is not comparable to recommendations of the NUREG-1801, XI.S8 program. Instead, the CNS service level I coating program is used to provide specific instructions for maintenance of safety-related coatings applied to concrete and steel surfaces within the drywell and torus. Although the CNS CII Program is not used to inspect service level I coating, the coatings in the purview of the program that show signs of degradation are reported for review and evaluation under the service level I coating program. The applicant stated that the service level I coating program addresses surface preparation, approved coating material, coating application, qualification of personnel, and coating inspection requirements for repair or replacement of existing coatings within the drywell and torus.

The applicant also stated that drywell and torus coatings are inspected during each RFO to ensure that the coatings remain intact and do not become potential debris sources. The applicant further stated that the service level I coating program addresses application, maintenance, and inspection of the service level I coating in the containment. The program specifies visually inspecting the coating surfaces for adverse coating conditions such as flaking, peeling, blistering, discoloration, and other signs of distress.

Coating showing signs of degradation are documented in the CNS corrective action program, reviewed, and evaluated for acceptability, repair, or replacement. The inspections would be performed by inspectors that are certified to American Society for Testing and Materials (ASTM) D4537, “Standard Guide for Establishing Procedures to Qualify and Certify Inspection Personnel for Coating Work in Nuclear Facilities.” Furthermore, the applicant stated that the service level I coating program will remain applicable during the period of extended operation.

The applicant also stated that in response to NRC Bulletin 96-03 dated May 6, 1996, “Potential Plugging of Emergency Core Cooling Suction Strainers by Debris in Boiling-Water Reactors,” CNS implemented the ECCS suction strainer modification. The modification increased the strainer surface by installing large capacity passive strainers thus ensuring that the resulting debris loading will not result in the available net positive suction head pressure falling below that required for ECCS pump operation during a postulated loss of coolant accident. The staff has previously reviewed the CNS response to NRC Bulletin 96-03 and found it to be satisfactory (Letter from David L. Wigginton to Mr. G. R. Horn, dated December 17, 1998).

The staff evaluated the information provided by the applicant, and found that the application of the CNS CII Program, in conjunction with the service level I coating program, is acceptable in managing coating degradation on the torus shell since coating degradation identified by the CII is reviewed and evaluated under the service level I coating program. The staff has found the method in which the program monitors the application and maintenance of protective coating acceptable since it provides assurance that coating will not become detached, creating a source of potential debris that may impact the operability of post-accident safety systems. The staff finds the frequency of the inspection of the coatings in the drywell and torus to be acceptable since inspecting every RFO would provide adequate assurance that there is proper maintenance of the protective coatings. The staff has found the method of performing the coatings inspection acceptable since visual inspections are performed to detect adverse coating conditions such as flaking, peeling, blistering, discoloration, and other signs of distress. The staff has also found acceptable the manner in which coating degradation is documented since identified degradation is submitted to the corrective action program, reviewed, and evaluated for acceptability, repair, or replacement. In addition, the qualification of personnel who perform the inspection is found to be acceptable since the staff has confirmed that the ASTM D4537 is acceptable. Therefore, the staff’s concern in RAI B.1.10-5, addressing degradation of the protective coatings in containment as a potential challenge to the ECCS, is resolved.

During the audit, the staff also reviewed condition reports which discussed the possibility of recoating the torus in response to torus pitting and corrosion. By letter dated June 29, 2009, the staff issued RAI B.1.10-2, asking the applicant to discuss any plans to recoat the torus prior to or during the period of extended operation.

In its response dated July 29, 2009, the applicant stated that there are no current plans to recoat the interior of the entire torus. The applicant further stated that the torus will continue to be inspected in accordance with the ASME Section XI, Subsection IWE during the period of extended operation, and indications will be evaluated to determine the appropriate corrective actions, including recoating if necessary.

The staff reviewed the applicant's response to RAI B.1.10-2 and requested the applicant to provide additional information in RAI B.1.10-6. The staff's concern is that the large number of repairs, excessive zinc depletion, and pitting at thousands of locations to the torus during the last 35 years may affect the integrity of the torus coating and could affect the integrity of the torus shell during the period of extended operation. In addition, CNS internal documents concerning self assessment of the torus coating have previously recommended recoating of the torus. For these reasons, the staff requested the applicant to provide detailed justification for not making a commitment to recoat the torus prior to the start of the period of extended operation.

In its response to RAI B.1.10-6, dated December 21, 2009, the applicant stated that a total of approximately 2,200 coating repairs have been made to the torus shell since 2001. Out of these 2,200 locations, 18 locations had pits where the nominal thickness has been reduced by greater than 10 percent of the nominal shell thickness. The applicant also stated that an engineering evaluation was performed that determined that loss of material at the 18 pits was acceptable. Therefore, the applicant has not performed any supplementary volumetric examination (UT) at these 18 pits that are located under water. However, the applicant performs augmented visual testing (VT) of the wetted surfaces of the torus once during each inspection period (3 times in 10 years) as required by the ASME Code. The applicant further stated that it has no plans to perform UT examination of the wetted surface of the torus shell because divers visually inspect the shell surface from the inside, every other outage. In conclusion, the applicant stated that the CNS ASME Section XI, IWE Program will provide effective aging management of the torus during the period of extended operation; however, recoating remains an option, if warranted in the future.

The staff reviewed the applicant's response to the RAI B.1.10-6, and found it unacceptable because the applicant did not adequately address the issue of how the torus coating can be effective through out the period of extended operation. The continued operating history of coating repairs and torus shell degradation, as mentioned by the applicant above, indicate that depletion of the zinc coating has reduced the ability to provide corrosion protection to the exposed steel substrate and localized coating failures have exposed areas of bare steel. In addition, the applicant did not provide or consider information regarding coating repairs performed prior to 2001--during the first 25 years of the plant operation.

The extent of the applicant's management of the coating failures has been making repairs only to areas that have had localized zinc coating failures where the depth of the pits exceed a threshold (generally 30 to 50 mils). The coating is repaired locally by applying an epoxy intended to arrest the pitting. However, coating at pits that do not exceed the threshold is not repaired but monitored at the next inspection (3 years later) for growth. This process has not been successful in that it has apparently resulted in localized galvanic corrosion which can yield higher and unpredictable corrosion rates (pitting) than that of general corrosion. It has also contributed to the amount of sludge and corrosion products collecting in the suppression pool, which can further increase the corrosion rate. The staff finds the applicant's attempt to manage pitting corrosion in the context of structural integrity without correcting the root causes unacceptable, since a through-wall pit would ultimately impact containment integrity without necessarily impacting structural integrity.

The staff also issued RAI B.1.10-3, by letter dated June 29, 2009, asking the applicant to discuss the process for managing aging effects on the primary containment, as industry experience has shown that the suppression chamber, or torus, in BWR Mark I containments may be susceptible to accelerated corrosion rates. The process should capture the aging effects in a timely fashion and show that the structure remains within the ASME code allowable values. The staff also asked for an explanation of how the IWE required inspection results were tracked as part of the AMP.

In its response to RAI B.1.10-3, dated July 29, 2009, the applicant stated that examinations of the torus are performed by qualified VT examiners in accordance with the ASME Code Section XI. The applicant further stated that conservative site-specific evaluation criteria are used to determine if pits should be immediately recoated or tagged for additional evaluation. The criteria are above the minimum required design thickness of the torus shell and penetration areas. The applicant also explained that examination results are recorded on data sheets and tracked under the CII Program. Currently no pits have been identified that require repair in accordance with the ASME Code.

The staff reviewed the response and finds that it explains how the applicant is using the code required examinations to capture and evaluate degradation within the CII Program, as recommended by the GALL Report. However, the staff's concern remains regarding the issue of accelerated corrosion of bare metal once the zinc coating on the torus is degraded and depleted.

During the audit, the staff reviewed the CNS calculations that justified continued operation of the suppression chamber with current pitting corrosion until July 2009. This calculation assumed a corrosion rate of 0.0026 in. per year. By letter dated June 29, 2009, the staff issued RAI B.1.10-4 asking the applicant to explain how the corrosion rate was determined, and how the pitting will be addressed during the period of extended operation when the current calculation says the condition of the torus is acceptable only until July 2009.

In its response to RAI B.1.10-4, dated July 29, 2009 the applicant explained that the corrosion rate was based on the maximum pit growth observed over approximately 13 years. The rate was determined by comparing the results of the 2005 inspections to those identified approximately 13 years earlier. The applicant further stated that the reviewed calculation provides evaluation of pits and a justification for continued operation of the torus that had been updated in 2005, to reflect the inspection results. In 2008, the applicant re-evaluated the acceptability of the pitting in the torus based on 2008 inspection results. This evaluation concluded that the torus is acceptable until at least 2014 and the calculation is being revised to reflect this conclusion. The applicant also explained that the torus will continue to be inspected during the period of extended operation, and the calculation will continue to be updated to reflect the most recent results.

The staff reviewed the response and finds that the corrosion rate is based on the highest torus degradation recorded at CNS over a 13-year period. Although the most recent inspection results and evaluations appear to demonstrate that the torus condition is acceptable through 2014 the evaluations and the response do not discuss the possibility of an acceleration in localized galvanic corrosion rates (pitting) due to the degraded torus coating. As previously noted, pitting corrosion rates are typically much higher and less predictable than general corrosion rates, and a through-wall pit would impact containment integrity without necessarily impacting structural integrity. The continued degradation and depletion of zinc coating, accelerated and unpredictable corrosion rates at the bare metal pits that are inspected underwater every three years do not provide reasonable assurance that a through wall pit will not develop in the torus during the period of extended operation. Therefore, the staff determined that the applicant has not provided preventive measures that will be used to mitigate the effects of widespread pitting corrosion during the period of extended operation. The staff considers recoating of the inside surface of the torus a preventive measure.

Based on the review of the applicant's response to RAIs B1.10-2, B1.10-4, and B.1.10-6, as noted above, the staff has determined that the applicant has not fully considered the cumulative effect of more than 2200 pits identified since 2001 on the structural integrity of the torus during the period of extended operation, nor has it provided any information on the number of coating degradations and pits in the torus between 1974 and 2001 that may also factor into such effects. The total population and effects of these pits, along with those that may develop by the next monitoring period, may lead to an accelerated and unpredictable corrosion rate on bare metal as a result of the degraded and depleted zinc coating. Ultimately, through-wall pits in the torus could develop during the period of extended operation. Therefore, the staff has concluded that the applicant has not demonstrated that the effects of the torus degradation will be adequately managed so that the intended function will be maintained for the period of extended operation in accordance with 10 CFR 54.21(a)3. This issue remains unresolved as open item OI 3.0.3.2-1.

On the basis of its review and the applicant's response to the above RAIs, pending resolution of the open item, 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 LRA program element acceptable.

USAR Supplement. In LRA Section A.1.1.10, the applicant provided the USAR supplement for the Containment ISI Program. The applicant also committed to implementing the enhancements prior to the period of extended operation (Commitment 5). The staff reviewed this section and determined that the information in the USAR supplement conforms to the supplement provided in SRP-LR Table 3.5-2 for similar programs. Therefore, the staff determined the supplement is an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Containment ISI Program, pending resolution of the open item OI 3.0.3.2-1, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancements and confirmed that their implementation through Commitment 5 prior to the period of extended operation would make the existing AMP consistent with the GALL AMP XI.S1 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, in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

3.0.3.2.7 Containment Leak Rate Program

Technical Information in the Application. LRA Section B.1.11 describes the existing Containment Leak Rate Program as an existing program which is consistent, with exceptions, with The GALL AMP XI.S4, "10 CFR Part 50, Appendix J." The applicant indicated that leak rate tests assure that leakage through reactor containment and systems and components penetrating containment does not exceed allowable values as specified in the technical specifications. The applicant further stated that periodic surveillance of reactor containment penetration and isolation valves is performed so that proper maintenance and repairs are made. The applicant also stated that it uses Option B, the performance-based approach, to implement the requirement of containment leak rate monitoring and testing.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The staff reviewed the exceptions to the GALL AMP XI.S4, to determine if the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits it

The staff reviewed the applicant's on-site documentation supporting the applicant's conclusion that the program elements for which it claims consistency are consistent with the elements in the GALL Report. The staff also confirmed that the plant program contains all of the elements of the referenced GALL Report and that the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated. The staff conducted onsite interviews with the applicant to confirm these results.

In comparing the program elements in the applicant's program to those in GALL AMP XI.S4, the staff noted that the program elements in the applicant's claim of consistency with the GALL Report were consistent with the GALL AMP XI.S4.

Exception 1. LRA Section B.1.11 states an exception to the GALL Report "monitoring and trending" program element as follows:

> NUREG-1801 recommends testing in accordance with 10 CFR Part 50, Appendix J, paragraph III.C.1, which requires Type C tests to be performed by local pressurization and applied in the same direction as the valve when it performs its safety function. CNS performs reverse direction local leak rate testing of four containment isolation valves.

The LRA further states that CNS has been granted an exemption from 10 CFR Part 50, Appendix J to allow reverse-direction local leak rate (Type C) testing of four containment isolation valves.

The staff reviewed this exception and noted that the original exemption, as well as the wording of the exception in the LRA, applies to Option A of Appendix J; however, the applicant has committed to Option B. The staff reviewed CNS license amendment 180, issued on March 3, 2000, which authorized the use of Option B. This amendment discusses the exemption and incorporates it into the approved Containment Leakage Rate Testing Program. On the basis that the staff previously granted an exemption, which was not time dependent, the staff determined that this exception is acceptable.

Exception 2. LRA Section B.1.11 states an exception to the GALL Report, "monitoring and trending" program element as follows:

> NUREG-1801 recommends testing in accordance with 10 CFR Part 50, Appendix J, paragraphs III.B.2 and III.C.2, which requires testing on containment isolation valves (Type C test) and containment penetrations (Type B test), respectively, at peak calculated containment pressure. CNS performs MSIV [main steam isolation valve] testing at 29 psig and expansion bellows testing at 5 psig.

The LRA further states that CNS has been granted an exemption from 10 CFR Part 50, Appendix J to allow MSIV testing at 29 psig and expansion bellows testing at 5 psig between the plies.

The staff reviewed this exception and noted that the original exemption, as well as the wording of the exception in the LRA, applies to Option A of Appendix J; however, the applicant has committed to Option B. The staff reviewed CNS license amendment 180, issued on March 3, 2000, which authorized the use of Option B. This license amendment discusses the exemption and incorporates it into the approved Containment Leakage Rate Testing Program. On the basis that the staff previously granted an exemption, which was not time dependent, the staff determined that this exception is acceptable.

Exception 3. LRA Section B.1.11 states an exception to the GALL Report, "acceptance criteria" program element as follows:

> NUREG-1801 recommends testing in accordance with 10 CFR Part 50, Appendix J, sections III.A and III.B, which requires tests to measure an overall containment integrated leak rate and to measure local leakage rates at pressure retaining boundaries and isolation valves, respectively. CNS excludes the main steam isolation valve leakage contributions from the overall integrated leakage rate Type A test measurement and from the sum of the leakage rates from Type B and Type C tests.

The LRA further states that CNS has been granted an exemption from 10 CFR Part 50, Appendix J to exclude the MSIV leakage contributions from the overall integrated leakage rate Type A test measurement and from the sum of the leakage rates from Type B and C tests.

The staff reviewed this exception and noted that the above exemption from Appendix J testing was granted by the staff in Amendment No. 226 to the operating license for CNS dated October 31, 2006. On the basis that the staff previously granted an exemption, which was not time dependent, the staff determined that this exception is acceptable.

Operating Experience. The staff also reviewed the OE described in LRA Section B.1.11. The staff reviewed a sample of condition reports and interviewed the applicant's technical staff to confirm that the plant-specific OE did not reveal any degradation not bounded by industry experience. In the LRA, the applicant described several instances where penetration leak rates did not meet administrative limits. During the audit, the staff reviewed documentation showing that the penetrations were repaired and retested and found to be acceptable. The staff found that proper corrective actions were taken to address the high penetration leak rates. The staff also noted reoccurring issues with failures of FW check valves during past Type C tests. The applicant explained that these valves had been replaced and the issue had been resolved. The staff confirmed this by reviewing past test results. On the basis of its review, the staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

USAR Supplement. In LRA Section A.1.1.11, the applicant provided the USAR supplement for the Containment Leak Rate Program. The staff reviewed this section and determined that the information in the USAR supplement is an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Containment Leak Rate Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exceptions and their justifications and determines that the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits it. 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, in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

3.0.3.2.8 Diesel Fuel Monitoring Program

Summary of Technical Information in the Application. LRA Section B.1.12 describes the existing Diesel Fuel Monitoring Program as being consistent, with exceptions and enhancements, to the GALL AMP XI.M30, "Fuel Oil Chemistry."

The applicant indicated that this program consists of sampling fuel oil to ensure that fuel oil quality is maintained in order to prevent loss of material in fuel systems. The applicant further stated that exposure to water and microbiological growth in the fuel oil is minimized by periodic sampling and analysis, draining and cleaning of tanks, and verifying the quality of new fuel oil prior to being placed into the storage tanks. The applicant also stated that the sampling and analysis of fuel oil is consistent with technical specifications and the ASTM Code Standards D4057 and D975. Furthermore, the Diesel Fuel Monitoring program effectiveness will be verified by the One-Time Inspection program.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the exceptions and enhancements to determine whether the AMP, with the exceptions and enhancements, is adequate to manage the aging effects for which the LRA credits it.

The staff also confirmed that the plant program contains all of the elements of the referenced GALL Report and that the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated. The staff conducted onsite interviews with the applicant to confirm these results.

In comparing the elements in the applicant's program to those in the GALL AMP XI.M30, the staff determined that those program elements, for which the applicant claimed consistency with the GALL Report, are consistent.

Exception 1. LRA Section B.1.12 states an exception to the program element, "scope of program," in that particulate testing will be performed using only the guidelines of the ASTM Code Standard D2276. The GALL Report recommends the use of ASTM Standards D2276 and D6217 for particulate testing. The applicant indicated that the ASTM Code Standard D2276 is specified by its plant technical specifications. The staff noted that the GALL Report recommends that the fuel oil purity is maintained in accordance with the plant's technical specifications and that the ASTM Code D2276 is recommended by GALL AMP XI.M30. The staff reviewed the

ASTM Code Standards D2276 and D6217 and noted that both test methods are similar in that a 0.8µm test membrane filter is used to filter a known volume of fuel oil and then the test membrane filter is weighed to determine the increase in mass due to the particulates in the fuel oil compared to control test membrane. The staff also noted that both test methods utilize solvents to wash the test membrane filters which are weighed after they are dried and the results of each method is reported in units of g/m^3 or mg/L. During its comparison, the staff noted that the ASTM Code D2276 uses a sample volume of 3.785L to 5L and the ASTM Code D6217 uses a 1L sample volume. The staff noted that the ASTM Code D2276 is more conservative because a larger volume of fuel oil is being filtered through the 0.8µm test membrane filter, increasing the likelihood of capturing more particulates and yielding a more conservative result for the concentration of particulates.

On the basis of its review the staff determined that this exception is acceptable because: (1) the applicant is using the guidelines of the ASTM Code D2276 which is a recommended standard in the GALL Report and is in accordance with the plant's technical specifications to maintain fuel oil purity, (2) both test methods utilize a 0.8µm test membrane filter and share similar procedures for testing the fuel oil for particulates, and (3) the ASTM Code D2276 filters a larger sample volume of fuel oil which will yield a more conservative result for the concentration of particulates.

Exception 2. LRA Section B.1.12 states an exception to the "scope of program," "parameters monitored or inspected," and "acceptance criteria," program elements in that only the ASTM Code D1796 is used for testing water and sediment, whereas the GALL Report recommends the use of the ASTM Code Standards D1796 and D2709. The staff compared the ASTM Code D1796 and D2709 and noted that both test methods are performed by the centrifuge method to test for water and sediment, however, each test method is meant for different grades of fuel oil. During its audit the staff reviewed the applicant's Technical Specification Bases document and noted that in Section B.3.8.3 it states fuel oil sample tests are performed in accordance with the ASTM Code D975-89a, under its CLB. The staff notes that the ASTM Code D975 provides standard specifications for several grades of diesel fuel oil. The staff further notes that the ASTM Code D975 references the sampling and test methods that are recommended in the GALL Report. The staff reviewed this standard and noted that the ASTM Code D975-89a, Section 1 states that Grades No. 1-D, 2-D, and 4-D fuel oil are within the scope of this standard. The staff further noted that ASTM D975-89a, Section 4.1.3 states that ASTM D1796 is used to test for water and sediment for the type of fuel oil used at CNS. In the LRA, the applicant indicated that these two test methods are applicable to fuel oils of different viscosities and that the ASTM Code D1796 is appropriate for the fuel oil that is used at CNS. The staff determined that the applicant is utilizing the ASTM Code D1796 in accordance with its Technical Specifications Bases and CLB.

On the basis of its review, the staff determined that this exception is acceptable because: (1) both test methods recommended by the GALL Report utilize a centrifuge method to test for water and sediment and (2) the applicant uses the appropriate test method, the ASTM Code D1796, in accordance with CNS's Technical Specification Bases.

Exception 3. LRA Section B.1.12 states an exception to the "parameters monitored or inspected" and "acceptance criteria" program elements in that the determination of particulates is according to non-modified ASTM Code D2276 Method A. The GALL Report recommends the use of a modified ASTM Code Standard D2276 Method A to determine particulates. The staff noted that the modification to the ASTM Code D2276, as recommended by GALL AMP XI.30, is the use of a 3.0µm test membrane filter instead of the 0.8µm test membrane filter, as stated in the standard. The staff noted that the use of the unmodified test method ASTM Code D2276

Method A will yield more conservative results because the use of a filter with the smaller pore size, 0.8μm, will capture more particulates than those captured by the 3.0μm filter.

On the basis of its review, the staff determined that this exception is acceptable because: (1) the applicant will be using the more conservative test membrane filter with a smaller pore size of 0.8μm compared to the 3.0μm recommended by the GALL Report and (2) the 0.8μm test membrane filter will capture more particulates than the 3.0μm membrane filter.

On the basis of its review, as described above, the staff determined that the applicant's exceptions and associated justifications are acceptable.

Enhancement 1. LRA Section B.1.12 states an enhancement to the GALL Report AMP in that the Diesel Fuel Oil Monitoring Program will be revised to use the ASTM Code Standard D4057 for sampling of the diesel fire pump fuel oil storage tank. The applicant indicated that this enhancement affects the "scope of program," "parameters monitored or inspected," and "acceptance criteria" program elements. The staff reviewed the corresponding program elements in GALL AMP XI.M30 and noted that the GALL Report recommends the use of the ASTM Code D4057 for guidance in fuel oil sampling. During its audit the staff confirmed that the applicant's current procedures utilize the ASTM Code D4057 for multilevel oil sampling in the diesel fuel oil storage tanks and diesel fuel oil day tanks. Therefore, the staff determined that the applicant's enhancement is only applicable to the diesel fire pump fuel oil storage tank. On the basis of its review, the staff finds this enhancement acceptable because when implemented prior to the period of extended operation, it will be in accordance with the GALL AMP XI.M30.

Enhancement 2. LRA Section B.1.12 states an enhancement to the "preventive actions" program element to include periodic visual inspections and cleaning of the diesel fuel oil day tanks, the diesel fuel oil storage tanks, and the diesel fire pump fuel oil storage tank. The staff reviewed the corresponding program element in the GALL AMP XI.M30 and noted that the GALL Report recommends periodic cleaning of tanks to allow the removal of sediments and contaminants that are in the tank, which is effective in mitigating corrosion inside the storage tanks. The staff noted that this enhancement is applicable to all diesel fuel oil tanks in the scope of this program. On the basis of its review, the staff finds this enhancement acceptable because when implemented prior to the period of extended operation, it will be consistent with the recommendations in the GALL AMP XI.M30.

Enhancement 3. LRA Section B.1.12 states an enhancement to the "detection of aging effects" program element to include: (1) periodic multilevel sampling of the diesel fuel oil day tanks and the diesel fire pump fuel oil storage tank; (2) periodic visual inspections; and (3) ultrasonic bottom surface thickness measurement of the diesel fuel oil day tanks, the diesel fuel oil storage tanks, and the diesel fire pump fuel oil storage tank. The staff reviewed the corresponding program element in the GALL AMP XI.M30 and noted that the GALL Report recommends periodic multilevel sampling, periodic visual inspections of the interior of the tanks and ultrasonic thickness measurements of the tank bottoms to ensure that significant degradation has not occurred. During its audit the staff confirmed that the applicant's current procedures include multilevel sampling for the diesel fuel oil storage tanks. Therefore, the staff determined that the applicant's enhancement is only applicable to the diesel fuel oil day tanks and the diesel fire pump fuel oil storage tank. On the basis of its review, the staff finds this enhancement acceptable because when implemented prior to the period of extended operation, it will be consistent with the recommendations in the GALL AMP XI.M30.

Enhancement 4. LRA Section B.1.12 states an enhancement to the "acceptance criteria" program element to provide the acceptance criterion of 10 mg/L for the determination of particulates in the diesel fire pump fuel oil storage tank. The staff reviewed the corresponding program element in the GALL AMP XI.M30 and noted that the GALL Report does not specifically identify this limit on the concentration for particulates. However, upon review of the CNS Technical Specifications, Section 5.5.9 and NUREG-1431 “Standard Technical Specifications Westinghouse Plants,” Volume 1, Revision 3, Section 5.5.13, the staff noted that the acceptance criterion of greater than or equal to 10 mg/L for the determination of particulates is consistent with the proposed enhancement. The staff further noted that program description and scope of program element recommends the use of the plant’s technical specifications and NUREG-1431 for fuel oil purity guidelines. During its audit the staff confirmed that the applicant’s current procedures have an acceptance criterion of greater than or equal to 10 mg/L for the determination of particulates for the diesel fuel oil storage tanks and diesel fuel oil day tanks. Therefore, the staff determined that the applicant’s enhancement is only applicable to the diesel fire pump fuel oil storage tank. On the basis of its review, the staff finds this enhancement acceptable because when implemented prior to the period of extended operation, it will be in accordance with the GALL AMP XI.M30.

Enhancement 5. LRA Section B.1.12 states another enhancement to the ”acceptance criteria” program element by specifying an acceptance criteria for UT thickness measurements of the bottom surfaces of the diesel fuel oil day tanks, the diesel fuel oil storage tanks, and the diesel fire pump fuel oil storage tank. The staff reviewed the corresponding program element in GALL AMP XI.M30 and noted that there is not an acceptance criteria specified for the ultrasonic measurements for the tank bottoms. The staff noted that the applicant is appropriately identifying an acceptance criterion for the ultrasonic tests for measurements of tanks bottoms so that corrective actions can be initiated. However, the applicant did not provide information pertaining to how the acceptance criteria for the UT thickness measurements of the bottom surfaces will be established. Therefore, by letter dated May 1, 2009, the staff issued RAI B.1.12-1 requesting the applicant clarify how the acceptance criteria for the UT thickness measurements of the bottom surfaces will be established and the basis for this criteria. By letter dated June 15, 2009, the applicant responded to the staff’s RAI by stating that the acceptance criteria for the UT measurements on the tank bottoms are based on the as-built component information and adjusted for corrosion allowance. The applicant further stated that if the UT measurements indicate a wall thickness of less than the minimum nominal thickness minus the corrosion allowance, an engineering evaluation will be performed. The staff noted that this engineering evaluation will determine the acceptability of the measured thickness and consider potential future corrosion to ensure that subsequent inspections occur prior to the wall thickness becoming unacceptable. The staff finds the applicant’s response acceptable because: (1) the applicant’s acceptance criteria for the UT thickness measurements will be based on the thickness of the tank as it was built and (2) the applicant will initiate corrective actions if the UT measurements are less than minimum nominal thickness minus the corrosion allowance. On the basis of its review, the staff finds this enhancement acceptable because when implemented prior to the period of extended operation it will be consistent with the recommendations in the GALL AMP XI.M30.

On the basis of its review, the staff finds this enhancement acceptable because when implemented prior to the period of extended operation, the applicant’s program will perform UT measurements of tanks bottoms with an established acceptance criterion based on the as-built thickness to initiate corrective actions, that is consistent with the recommendations in the GALL AMP XI.M30.

On the basis of its review, as described above, the staff finds the applicant’s enhancements identified above will make the existing program consistent with the GALL AMP XI.M30 to which it was compared, prior to the period of extended operation.

Operating Experience. The staff reviewed the OE described in LRA Section B.1.12 and also interviewed the applicant's technical staff to confirm that the plant-specific OE did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific OE have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed OE identified after the issuance of the GALL Report.

In LRA Section B.1.12 the staff noted that in 2005, the applicant was sampling the fuel oil in diesel oil storage tank B which showed indications of excessive water in the tank. Upon this discovery the applicant initiated corrective actions and performed a further evaluation that resulted in changing the sample points and the addition of dewatering drains. The applicant also made procedural changes to ensure proper sampling and drainage for an interim tank maintained on site, for incoming diesel fuel tanker shipments, and other fuel oil storage tanks on site. The applicant also dewatered the diesel storage tank B so it was within acceptable limits. The applicant indicated that in 2005 and 2006, samples taken from the same tank showed water; however, further evaluation of the results indicated that it was within acceptable limits. However, the staff requested additional information relating to the cause of the excessive water and if any inspections had been performed to verify the condition of the interior of the tank. The Staff also wanted confirmation as to whether or not loss of material/corrosion was occurring. If so, it wanted the results of these inspections. Therefore, by letter dated 2009, the staff issued an RAI B.1.12-2, dated May 1, 2009, requesting that the applicant: (1) clarify the cause of the excessive water in this storage tank, (2) state whether or not there have been any inspections to verify the condition of the interior of this tank and, if so, provide the results, and (3) state whether or not subsequent sampling results indicated excessive water or an adverse trend of water in the fuel oil.

By letter dated June 15, 2009, the applicant responded to the staff's RAI B.1.12-2 by stating that the apparent cause of water in the diesel oil storage tank B was from a "contingency" diesel fuel oil tanker that was utilized starting in May 2004. The applicant explained that this "contingency" tanker was used in the interim to supply fuel oil to the emergency diesel generators (DGs) during maintenance of the fuel oil storage tank and fuel oil transfer system. The applicant further explained that in September 2005, fuel oil that was contaminated with water was transferred from this "contingency" tanker into the diesel oil storage tank B. The staff noted that the applicant attempted to remove as much water as possible from the fuel oil storage B after the contamination with a pump and a bottom (thief) sampler as described in Technical Specification Bases SR 3.8.3.5. However there was still a small amount of water that remained in this storage tank (1.5 gallons of water).

The applicant indicated that the "contingency" tanker is no longer used at CNS and the corrective actions after this water intrusion event was to have a receipt-inspection fuel oil tanker compartment drain piping with a sample valve to facilitate periodic water sampling and water removal from the tanker drain piping. The staff noted that the applicant used this receipt-inspection fuel oil tanker to temporarily store new fuel oil until laboratory results indicated that the new fuel oil was acceptable to be transferred into the permanent fuel oil storage tanks. The applicant revised its procedures to require using these new sample valves to identify and remove water before the fuel oil is transferred from the receipt-inspection fuel oil tanker to permanent fuel oil storage tanks A and B. The applicant indicated that samples be taken from the diesel oil storage tank B after this event showed evidence of small amounts of water. The staff noted that the applicant clearly identified the cause of the water intrusion for the diesel oil storage tank B and the corrective actions taken to address the water intrusion.

The applicant responded to parts (2) and (3) by stating that in fall of 2004, the diesel oil storage tanks were blast cleaned, ultrasonically inspected, and then lined with an epoxy. The applicant further stated that the results of the inspections during the cleaning did not identify evidence of corrosion. The staff noted that the epoxy lining that was applied to the interior walls of the tank is designed to be a barrier between water and contaminants and the metal surface to prevent small amounts of water or contaminants in the tank from degrading underlying metal. The applicant indicated that because the epoxy lining protects the underlying metal from remaining small amounts of water or contaminants in diesel oil storage tank B, an inspection of the tank interior was not necessary after the water intrusion event. The applicant further stated that the next inspection of the tank interiors of the diesel oil storage tanks is scheduled for 2014 which is consistent with Regulatory Guide (RG) 1.137. The staff noted that the applicant has subsequently performed a bottom vacuum and high velocity recirculation on both diesel oil storage tanks in March 2009 to remove bottom water and particulates if any were present. The staff noted that the applicant has reviewed the results from the monthly samples taken from the bottom of the diesel oil storage tanks since the activities in March 2009, and has not identified evidence of water in diesel oil storage tank B.

On the basis of its review, the staff finds the applicant's response to RAI B.1.12-2 acceptable in its entirety because the applicant has: (1) demonstrated the effectiveness of its program to detect water from the fuel oil samples, (2) taken appropriate corrective actions to identify the source if the excess water and remove it from the diesel oil storage tank B, (3) inspected the diesel oil storage tank B with results that indicated no evidence of corrosion in the fall of 2004, (4) lined the interior of the tank with a thick-film epoxy to protect the metal surface from small amounts of water which defers the need to re-inspect the tank one year later, and (5) taken additional corrective actions in March 2009, to remove remaining water and particulates from the diesel oil storage tanks with results indicating no evidence of water in diesel oil storage tank B.

The applicant stated that industry OE in 2003 indicated that there was evidence of corrosion in diesel fuel storage tanks and that this information was reviewed to determine its applicability to CNS. The applicant further stated corrosion was discovered at CNS during cleaning activities. During its audit the staff noted that the value for the wall thickness to initiate further action is 0.25 inches. The applicant evaluated the condition and noted that the minimal wall thickness is 0.453 inches. In 2004 the applicant performed UT inspections of both storage tanks to 2 feet x 2 feet surface grids representing areas of the tank bottom, sides, top and heads and the results indicated that the minimum acceptable thickness was not exceeded. The applicant also coated the interiors of the tanks with a single coat of a thick-film epoxy after the UT inspections. The staff noted that the applicant has initiated appropriate corrective actions that include: (1) evaluation to determine if minimal wall thickness were maintained, (2) UT inspections of representative areas of the interiors, and (3) coating the interior of the tanks.

During its review the staff considered the information contained in NRC Information Notice (IN) 2006-22, "New Ultra-Low-Sulfur Diesel (ULSD) Fuel Oil Could Adversely Impact Diesel Engine Performance." The staff reviewed IN 2006-22 and noted that the use of ULSD may cause potential issues such as fuel particulate build-up, microbiological growth, and incompatibility with certain metals. During its audit the staff noted that in 2007, the applicant performed an evaluation to determine the effects of ULSD fuel oil on engine performance. The staff reviewed this report and noted that the applicant evaluated the individual effects of using ULSD, as described in ID 2006-22. The staff further noted the applicant has taken corrective actions to monitor the progress of ULSD fuel oil testing and future impact when more data is available. The applicant has currently amended its purchase orders for fuel oil to require sulfur content to be greater than 200 parts per million (ppm). The staff noted that the applicant has taken appropriate corrective actions to monitor the progress of ULSD and has currently amended its purchase orders for fuel oil to require sulfur content to be greater than 200 ppm to prevent the addition of ULSD in the fuel oil storage supply at CNS.

During its audit, the staff noted in August 2007, that the applicant discovered scaly debris in the DG1 diesel fuel oil day tank. The applicant collected a sample to be analyzed, inspected the interior of the tank to determine whether or not degradation had occurred, and then subsequently cleaned the tank. Based on this discovery the applicant appropriately issued a work order to inspect and clean the DG2 diesel fuel oil day tank. The applicant discovered the same type of debris in this day tank and then had the tank interior inspected and cleaned. The applicant had the samples from each diesel fuel oil day tank analyzed by Southwest Research Institute which determined that the debris was a mixture of fuel degradation products, rust, dirt or clay, and possibly microbiological growth. The applicant also performed an “apparent cause evaluation” which determined that the debris resulted from time based mechanisms that settled from fuel oil decomposition and suspended fuel oil particulates. The staff reviewed the applicant’s current maintenance plan to perform an internal inspection of both diesel fuel oil day tanks on a 234-week frequency. The staff noted that the applicant has taken appropriate corrective actions to clean and inspect both diesel fuel oil day tanks, to analyze the debris and perform an “apparent cause evaluation” and perform periodic internal inspections of tank interiors.

Based on its review, the staff finds: (1) that the OE for this AMP demonstrates that the AMP is achieving its objective of managing system components and (2) that the applicant is taking appropriate corrective actions through implementing this AMP.

The staff confirmed the “operating experience” program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this LRA program element acceptable.

USAR Supplement. LRA Section A.1.1.12 provides the applicant’s USAR supplement for the Diesel Fuel Monitoring Program. The staff confirmed that the applicant’s USAR supplement summary description for this program conforms to the staff’s recommended USAR supplement guidance found in the SRP-LR.

In Commitment No. NL2008071-06, the applicant committed to enhancing the existing program prior to the period of extended operation, by implementing the following:

- The Diesel Fuel Oil Monitoring Program will be revised to use ASTM Standard D4057 for sampling of the diesel fuel pump fuel oil storage tank.
- The Diesel Fuel Monitoring Program will be enhanced to include periodic visual inspections and cleaning of the diesel fuel oil day tanks, the diesel fuel oil storage tanks, and the diesel fire pump fuel oil storage tank.
- The Diesel Fuel Monitoring Program will be enhanced to include periodic multilevel sampling of the diesel fuel oil day tanks and the diesel fire pump fuel oil storage tank and to include periodic visual inspections as well as ultrasonic bottom surface thickness measurement of the diesel day tanks, the diesel fuel oil storage tanks, and the diesel fire pump fuel oil storage tank.

- The Diesel Fuel Monitoring Program will be enhanced to provide the acceptance criterion of less than or equal to 10mg/l for the determination of particulates in the diesel fire pump fuel oil storage tank.
- The Diesel Fuel Monitoring Program will be enhanced to specify acceptance criteria for UT thickness measurements of the bottom surfaces of the diesel fuel oil day tanks, the diesel fuel oil storage tanks, and the diesel fire pump fuel oil storage tank.

By letter dated June 15, 2009, the applicant amended its commitment NLS2008071-06 to NLS2008071-06 (Revision 1) in response to RAI B.1.12-1 to clarify how the acceptance criteria will be established. NLS2008071-06 (Revision 1) in a letter dated June 15, 2009, states:

> Enhance the program to specify acceptance criterion for UT thickness measurements of the bottom surfaces of the diesel fuel oil day tanks, the diesel fuel oil storage tanks, and the diesel fire pump fuel oil storage tank. [LRA Section B.1.12] The acceptance criteria for UT measurement of tank bottom thickness for the referenced diesel fuel tanks will be based on component as-built information adjusted for corrosion allowance. If measurements show less than the minimum nominal thickness less corrosion allowance, engineering will evaluate the measured thickness for acceptability under the corrective action program. Evaluation will include consideration of potential future corrosion to ensure that future inspections are scheduled before wall thickness becomes unacceptable. [RAI B.1.12-1]

The staff determined that the information in the USAR supplement is an adequate summary description of the Diesel Fuel Monitoring program, in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Diesel Fuel Monitoring Program, and the applicant's responses to the RAI's, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff reviewed the exceptions and their associated justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits it. The staff also reviewed the enhancements and confirmed that their implementation, through Commitment No. NL2008071-06 prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

3.0.3.2.9 External Surfaces Monitoring Program

Summary of Technical Information in the Application. LRA Section B.1.14 describes the existing External Surfaces Monitoring Program as consistent with the GALL AMP XI.M36, "External Surfaces Monitoring," with an enhancement.

The applicant indicated that the External Surfaces Monitoring Program inspects external surfaces of steel components such as piping, piping components, ducting and other components subject to an AMR. Also, as discussed later, the applicant stated that the program includes components constructed of aluminum, copper alloy, gray cast iron, nickel alloy, and stainless steel surfaces, whereas the GALL Report AMP states only steel components. The program is also credited with managing loss of material from internal surfaces for situations in which the internal and external material and environment combinations are the same so that the external surface condition is representative of the internal surface condition.

The applicant also stated that surfaces that are inaccessible during plant operations are inspected during RFOs and surfaces that are insulated are inspected when the external surface is exposed (i.e., during maintenance). Further, the applicant stated that these surfaces would be inspected at intervals to assure that the effects of aging are managed so that applicable components will perform their intended function during the period of extended operation.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the enhancement to determine if the AMP, with the enhancement, is adequate to manage the aging effects for which the LRA credits it. The staff audited the program elements of the External Surfaces Monitoring Program to verify consistency with the GALL AMP XI.M36. Details of the staff's audit of the applicant's AMP are documented in the Audit Report. In comparing the elements in the applicant's program to those in the GALL AMP XI.M36, the staff determined that those program elements for which the applicant claimed consistency with the corresponding elements in the GALL AMP XI.M36 were indeed consistent with the exception of those areas as described below.

The staff's review of the LRA identified areas in which additional information was necessary to complete the review of the applicant's program elements. The applicant responded to the staff's RAIs as discussed below.

With regard to the "scope of program" program element, the staff noted that the GALL AMP XI.M36 states that this program is limited to the detection of loss of material due to general, pitting, and crevice corrosion for components fabricated of steel only. During its audit, the staff noted in the program basis document that the applicant credits this program with managing the loss of material in aluminum, copper alloy, gray cast iron, nickel alloy, and stainless steel surfaces. In RAI B.1.14 -1, in a letter dated May 1, 2009, the staff requested that the applicant provide justification for expanding the scope of material as recommended by the GALL Report to include managing loss of material for aluminum, copper alloy, and stainless steel surfaces.

In a letter dated June 15, 2009, the applicant stated that:

> During the system walkdowns for the External Surfaces Monitoring Program, the system engineer visually checks a variety of system characteristics, including the physical condition of the external surfaces of all components, not just steel components. Consequently; crediting the External Surfaces Monitoring Program for the management of loss of material for materials other than steel, is a reasonable application of an existing inspection process.

Further, the applicant states in its program basis evaluation document that general corrosion of the surfaces of these other materials will manifest itself as visible rust or rust byproducts (e.g., discoloration or coating degradation) and be detectable prior to any loss of intended function. In RAI B.1.14 - 4, dated May 1, 2009, the staff requested that the applicant provide justification for claiming that general corrosion of surfaces of materials such as aluminum, copper alloy, gray cast iron, nickel alloy, and stainless steel that it is crediting under this program would manifest itself as visible rust or rust byproducts. Also, the staff questions whether general corrosion of stainless steel surfaces would manifest itself as visible rust or rust byproducts as this is not consistent with the GALL Report.

The applicant agreed in its June 15, 2009, letter that corrosion of these materials would not result in common rust but would be visible as discoloration of the material (stains), corrosion product deposits, pitting, or coating degradation if the material were coated. These aging effects would be visible through visual inspections long before its intended function would be affected.

The staff agrees that for these materials, stains, pitting, and coating degradation will show signs of degradation that will be visible in visual inspections during the External Surfaces Monitoring Program and as this degradation occurs so slowly that they will be visible before the components' function is lost.

The staff also notes that the GALL Report states that for aluminum components (items 3.2.1-50) and stainless steel, copper alloy, and nickel alloy components (items 3.2.1-53) exposed to indoor air, uncontrolled, that there are no aging effects and no AMP is needed. However, for outdoor air and air with condensation, there may be aging effects for these metals. Some corrosion, in the form of pitting and crevice corrosion is possible for these materials when wetted, as with the environments of outdoor air or condensation. Pitting and crevice corrosion in these materials is not as readily observable as general corrosion in steel, but it typically develops more slowly and is detectible by visible evidence of stains and pits long before it affects the intended function of a component. In that regard, all metallic components would corrode similarly and visual inspection will detect age related degradation. Based on its review, the staff finds the applicant's response acceptable and concludes that the External Surface Monitoring Program will adequately manage the aging effects of loss of material on external surfaces of all metallic components through the period of extended operation. This makes the External Surfaces Monitoring Program an effective means of managing loss of material for these materials.

With regard to the "scope of program" program element, the staff noted that the program basis document states that surfaces that are inaccessible or not readily visible during both plant operations and RFOs are inspected. In RAI B.1.14-2, dated May 1, 2009, the staff requested that the applicant specify the components that are not accessible during both plant operations and RFOs, how they will be inspected, and at what frequency they will be inspected to assure that aging effects will be managed during the period of extended operation.

The applicant replied in a letter dated June 15, 2009, indicating that:

> Components that are inaccessible or not readily visible during both plant operations and refueling outages include components in physically confined locations that prevent direct inspection, (e.g., piping in a chase with other pipes can present such a configuration). Some components are also inaccessible for personnel safety reasons, (e.g., components located in a high radiation area). The specific components that credit the External Surfaces Monitoring Program to manage loss of material have been identified. Some components that credit the program for the period of extended operation are not inspected because of their inaccessibility. However, the condition of these components is well represented by accessible components inspected during the comprehensive system walkdowns under the External Surfaces Monitoring Program. Just as NUREG -1801, XI.M36, permits the inference of internal surface conditions when the component's internal and external environments are the same, the condition of an inaccessible component can be inferred from an accessible system component of the same material in the same environment. Should degradation of accessible components be identified, evaluation of acceptability of inaccessible

> components is a standard part of determining the extent of significant conditions under the corrective action program.

The staff reviewed the applicant's response and noted that the applicant has identified the areas that are not readily accessible and has defined a mean of determining degradation of these inaccessible components and monitoring or correcting them in the corrective action program. The staff finds the applicant's response acceptable. The staff also noted that these inaccessible areas will be inspected when accessible during RFOs or maintenance. The staff concludes that this is acceptable and is adequate to manage the aging effects on these components that are not readily accessible.

With regard to the "scope of program" program element, the staff noted that the GALL AMP XI.M36 states that this program may be credited with managing loss of material from internal surfaces for situations in which material and environment combinations are the same for internal and external surfaces and that the program should describe the component internal environment and the credited similar external component environment inspected. In RAI-B.1.14-3, dated May 1, 2009, the staff requested that the applicant provide the documentation or the method of documentation for each component of the internal surface environment and the corresponding similar external surface environment for the internal component surfaces for which this program is being credited.

The applicant replied in its June 15, 2009, letter indicating that:

> The internal/external pairing is documented by pairs of lines in the aging management review results tables, Tables 3.X.2-Y, in Section 3 of the LRA. For each table line where the External Surfaces Monitoring Program is credited for an internal surface, (e.g., where the listed environment is air - indoor), the same component type will have a corresponding line crediting this same program for the external surface, (e.g., with the listed environment as air) AMP evaluation report for the External Surfaces Monitoring Program.

The staff reviewed the tables and found that the applicant had completely defined those components whose internal surfaces can be monitored through the External Surfaces Monitoring Program by inspecting its external surface. As the GALL Report states that this is an acceptable method for monitoring the internal surfaces of these components, the staff agrees that this is acceptable.

The staff noted that the applicant's "monitoring and trending" program element for the program did not describe explicitly the applicant's activities to track and trend degradation. In RAI B.1.14-5, in a letter dated May 1, 2009, the staff requested that the applicant describe: (1) the trending activities that will be used, (2) how the program will track reoccurrence of conditions, and (3) how it will provide predictability of the extent of degradation and thus timely corrective or mitigative actions.

In its June 15, 2009, reply the applicant stated:

> Its system engineers' manuals for conducting system walkdowns and for preparing condition reports as part of the corrective action program describe the system engineer's role in conducting system walkdowns emphasizing the importance of being familiar with the condition of his or her system. Although informal, trending by repetitive observations is effective for monitoring minor component degradation such that timely corrective or mitigative actions can be

> taken based on the extent and rate of change of degradation. If the degradation warrants, a condition report is written. The corrective action program also includes provisions for timely corrective or mitigative actions of individual equipment problems, trending of repetitive equipment degradation, and identification of adverse equipment trends.

The staff noted that the GALL Report does not require a formal trending but requires observed deficiencies to be documented using approved processes and procedures so that results can be trended. The staff concludes that the applicant has documented procedures that are acceptable and will provide timely tracking, monitoring, and followup to any deficiencies found during inspections.

The staff noted that the applicant's "acceptance criteria" program element states that engineering evaluations consider procedural requirements, CLB, and industry codes but does not state the specific codes and standards. In RAI B.1.14- 6, in a letter dated May 1, 2009, the staff requested that the applicant site the specific codes or standards that will be used to determine acceptability and at what point or using what criteria will corrective actions be implemented.

The applicant stated in its response dated June 15, 2009, that:

> As necessary, engineering evaluations of the condition will consider relevant procedural requirements, current licensing basis, industry codes, and standards to decide when corrective actions will be implemented. These requirements, codes and standards used in the evaluation, which are part of the current plant design basis, will depend on the system, the component and the condition. Some typical standards would be the ASME Code and site piping specifications or pressure temperature calculations that provide pipe wall thickness requirements.

The staff noted that the applicant's program includes a wide range of systems and variety of pipe and component sizes. The staff noted that the applicant will apply corrective actions in accordance with the specific code or standard applicable to the component design upon any detection or corrosion resulting from this AMP's inspections. Based on this review, the staff finds that the applicant's acceptance criteria are acceptable and meet the "acceptance criteria" program element" in the GALL AMP XI.M36.

Enhancement. In the LRA Section B.1.14, the applicant committed to implement the following enhancement to the program element "scope of program" program element:

External Surfaces Monitoring Program guidance documents will be enhanced to clarify that periodic inspections of systems in-scope and subject to an AMR for license renewal in accordance with 10 CFR 54.4 (a)(1) and (a)(3) will be performed. 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 an AMR for license renewal in accordance with 10 CFR 54.4 (a)(2).

The staff reviewed the enhancement to determine if the program with this enhancement will be adequate to manage the aging effects for which it is credited. Section 54.4 (a)(1), and (a)(3) of 10 CFR define the SSCs within the scope of the rule for the period of extended operation and identify the important functions (intended functions) of the SSCs that must be maintained. Section 54.4 (a)(2) of 10 CFR adds nonsafety-related systems, SCs whose failure could prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a).

The staff reviewed the proposed enhancement and in RAI.B.1.14-7, dated May 1, 2009, and requested that the applicant provide examples of: (1) hazards in areas surrounding the subject systems, and (2) SSCs in nearby systems that could impact the subject systems that are in the scope and subject to an AMR for the extended period of operation in accordance with 10 CFR 54.4 (a)(2).

In its response dated June 15, 2009, the applicant indicated that:

(1) examples of the types of hazards these systems could present include physical impact; pipe whip, jet impingement, spray, leakage or flooding. Section 2.1.1.2.2 of the LRA describes these hazards.

(2) inspections of nearby systems that could impact the subject systems will include SSCs that are in-scope and subject to an AMR for the period of extended operation, in accordance with 10 CFR 54.4(a)(2).

The enhancement will focus the walkdown inspections on surrounding mechanical systems. Structures and structural components will be inspected by the Structures Monitoring Program. The External Surfaces Monitoring Program will inspect components containing oil, steam, or liquid, and located in spaces containing safety-related equipment. Tables 3.2.2-8-1 through 3.2.2-8-6, 3.3.2-14-1 through 3.3.2-14-29, and 3.4.2-2-1 through 3.4.2-2-13 present the systems and components within the scope of license renewal and subject to an AMR for the period of extended operation in accordance with 10 CFR 54.4(a)(2). The components that credit the External Surfaces Monitoring Program to manage loss of material and its potential impact on safety-related components in the area are identified in these tables.

This enhancement will add a requirement to the existing plant guidance documents to include areas that surround the subject systems to identify potential hazards that could damage the system components. This is appropriate since these hazards could result in a loss of system function. Adding a requirement to inspect surrounding areas will provide assurance that no hazards exist and will make the AMP consistent with the recommendations in the GALL Report. On this basis, the staff finds this enhancement acceptable.

Operating Experience. The staff also reviewed the OE described in LRA Section B.1.14. The review was documented in the applicant’s External Surfaces Monitoring Program, OE review report that was reviewed by the staff during an onsite review. As stated in LRA Section B.1.14, for monitoring programs, such as the External Surfaces Monitoring Program, the applicant reviewed sample results to determine if parameters are being maintained in accordance with the program.

The staff interviewed the applicant's staff and also reviewed OE reports and confirmed that the plant-specific OE did not include any aging effects for systems and components within the scope of this program that are not bounded by industry OE. The applicant’s OE included detection of corrosion on component external surfaces, as well as external leakage from valves. These aging effects are consistent with industry OE, and this AMP includes aging management activities, such as visual inspections, that are appropriate to detect these aging effects. Corrective actions were taken in accordance with the plant corrective action program prior to a loss of intended function of the component.

To confirm the effectiveness of this program, the staff reviewed over two hundred plant CRs. Two of these CRs document the discovery of leakage on the turbine casing during a system walkdown of the HPCI system and the discovery of leakage of two valves in the RWCU system. The staff found documentation that indicated that the HPCI turbine casing leakage was documented and trended at that time. The staff also found that the valve leakage condition was documented; a work order was initiated to replace the two valves and the drain line piping containing the valves. The staff searched the applicant's condition reports database and did not find any reoccurrences of these conditions at these locations. These examples provide verification that system problems are being detected by the program and corrective actions are being implemented.

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 LRA program element acceptable.

USAR Supplement. In LRA Section A.1.1.14, the applicant provided the USAR supplement for the External Surfaces Monitoring Program. The staff confirmed that the applicant's USAR supplement summary description for this program conforms to the staff's recommended USAR supplement guidance found in the SRP-LR.

In Commitment NLS2008071-07, the applicant committed to enhance the program as documented in Section A.1.1.14, prior to entering the period of extended operation.

The staff determines the information in the USAR supplement is an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's External Surfaces Monitoring Program, including the applicant's responses to RAI numbers B.1.14-1 through B.1.14-6 the staff determined that those program elements, for which the applicant claimed consistency with the GALL Report, are consistent. Also, the staff reviewed the enhancement, including the applicant's response to RAI B.1.14-7, and confirmed that its implementation prior to the period of extended operation would make the existing program consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this program and concludes that it provides an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

3.0.3.2.10 Fatigue Monitoring Program

Summary of Technical Information in the Application. In LRA Section B.1.15, the applicant stated that, with enhancements, the existing Fatigue Monitoring Program (FMP) is consistent with GALL AMP X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary." The applicant stated that this program tracks the number of critical thermal and pressure transients for selected reactor coolant system components, in order not to exceed design limits on fatigue usage. The applicant stated that this program ensures the validity of analyses that the actual number of transients does not exceed the assumed limit. In addition, the applicant stated that the FMP also addresses the effects of the coolant environment on component fatigue life by assessing the impact of the reactor coolant environment on a sample of critical components for the plant.

Staff Evaluation. During its audit and review, the staff reviewed the onsite document entitled Fatigue Monitoring, CNS-RPT-07-LRD02, Revision 1, dated September 9, 2008, to verify the applicant's claim of consistency with the GALL Report. Through the review, the staff found there are several program elements requiring clarification before consistency with the GALL Report could be confirmed. While most of the points were cleared through interviewing the applicant's technical staff, the staff issued eight RAIs to address its concerns about the issues, as described below.

A clarification for program element 2, "preventive actions," was necessary. The cited CNS onsite document stated that the FMP uses the systematic counting of design cycles and the evaluation of operating data to ensure that component design fatigue limits are not exceeded. It also stated that the effects of the reactor water environment on fatigue life of components would be included through implementation of the enhancement for the FW nozzles, CS nozzles, and RHR pipe transition. It was unclear to the staff why only three components or locations are being used to evaluate the environmental effects when NUREG/CR-6260 recommends six components or locations to be evaluated. In addition, in bullet (2) of element 2 subsection b, it states that CNS will "repair or replace the affected locations before exceeding a CUF of 1.0." It was unclear to the staff whether the CUF of interest accounts for the effects of the reactor water environment. Therefore, the staff issued RAI B.1.15-1, by letter dated May 1, 2009, requesting the applicant, (a) to describe the locations that are monitored in the FMP for license renewal, and (b) to clarify whether the environmental effects are included in maintaining the CUF within the limit of 1.0.

In its response to RAI B.1.15-1, Part (a), dated June 15, 2009, the applicant stated that the FMP of CNS counts the occurrence of transients and compares the actual cycles incurred against the analyzed cycles for all the components at CNS, not limited to specific components. The applicant also stated that CNS has applied environmental correction factors (F_{en}) to fatigue analyses for the six locations identified in NUREG/CR-6260 for a BWR of CNS's vintage, as shown in LRA Table 4.3-3. The applicant further stated that the six locations from NUREG/CR-6260 equated to nine plant-specific locations at CNS. The applicant indicated that of those nine locations, six were shown to be acceptable and the remaining three locations (FW nozzles, CS nozzles, and RHR pipe transition) are addressed by the subject enhancement to the FMP. The applicant further stated that cycle counting during the period of extended operation confirms the ongoing validity of the assumed numbers of cycles in all of the fatigue analyses that are based on assumed numbers of cycles.

Based on its review, the staff found the applicant's explanation acceptable because LRA Section 4.3 and Table 4.3-3 have included all NUREG/CR-6260 components/locations in evaluating the effects of reactor water environment on the fatigue life of components. The three locations (FW nozzles, CS nozzles, and RHR pipe transition) which were identified through the environmental fatigue analysis to have the environmentally adjusted CUF values exceeded the limit during the period of extended operation (as shown in LRA Table 4.3-3), to be managed by the FMP during the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii). Therefore, the concern identified in RAI B.1.15-1 Part (a) is resolved.

In its response to RAI B.1.15-1, Part (b), the applicant stated that the parameter CUF shown in CNS-RPT-LRD02, Revision 1, Section 4.7 B.2b bullet (2) is the CUF adjusted for environmental effects. As a result of this RAI, the applicant modified Item (2) of the enhancement shown in LRA Section A.1.1.15 and LRA Section B.1.15, where the term "a CUF" is changed to "an environmentally adjusted CUF."

Based on its review, the staff found the applicant's clarification acceptable because the applicant confirmed that the CUF indicated in the program enhancement includes the effects of the reactor water environment. Therefore, the concern identified in RAI B.1.15-1 Part (b) is resolved.

A clarification for program element 3, “parameters monitored or inspected,” was necessary. The onsite basis document CNS-RPT-LRD02, Revision 1, stated that CNS FMP only monitors the design cycles of the transients used in the RCS component design analyses. However, element 3 of NUREG-1801 Section X.M1 recommends that the AMP monitor all plant transients that are significant contributors to the fatigue usage factor. Therefore, the staff issued RAI B.1.15-2, by letter dated May 1, 2009, requesting that the applicant provide a list of transients that would contribute to fatigue usage but was not included in the design transients.

In its response to RAI B.1.15-2, dated June 15, 2009, the applicant stated that the FMP tracks transients that contribute to fatigue usage in CLB fatigue calculations. In the RAI response, the applicant also stated that NPPD has added analyzed transients to the FMP as they have been identified and thus Table 4 3-1 lists more transients than the transients identified in USAR Table III-3-I, such as FW cycling and turbine roll. In addition, the applicant stated that it recently identified actuation of a safety/relief valve as a transient for the primary containment, and documented it in its AMP as the second enhancement item.

Based on its review, the staff found the applicant’s response to this RAI appropriate because it demonstrated its willingness to add newly identified transients to the FMP to ensure all plant transients that are significant contributors to the fatigue usage factor are monitored.

A clarification for program elements 4 and 5, “detection of aging effects” and “monitoring and trending,” respectively, was necessary. For program element 4, the onsite basis document, CNS-RPT-LRD02, Revision 1, stated, “No actions are taken as part of this program to detect aging effects…. If a design cycle assumption is approached, corrective action is taken which will include update of fatigue usage calculation, if necessary.” It was unclear why taking “no action” would achieve the goal of detecting aging effects.

For program element 5, the same onsite basis document stated that CNS will monitor the FW nozzle for the effects of reactor water environment on the fatigue life of components. It was unclear why CNS only identified the FW nozzle to be monitored for environmental effects when the GALL Report identified all applicable NUREG/CR-6260 components, at minimum, are monitored for the environmental effects on component fatigue life. Therefore, the staff issued RAI B.1.15-9, by letter dated June 8, 2009, requesting the applicant to explain:

(a) How taking “no action” will achieve the goal of detecting aging effects.

(b) Why “design cycle” can be used as basis for detecting aging effects when the design transients do not include all thermal events actually experienced by the RCPB components, as discussed in RAI B.1.15-2.

(c) How design cycles can be used as criteria to detect aging effects when the LRA states that the environmental fatigue analyses were performed based on the 60-year projected cycles and the LRA Table 4.3-1 shows that the 60-year projected cycles for most of the transients are less than the design cycles. This means that components could have failed before the design cycles are approached. Provide justification that the design cycles can be used as reference to detect aging effects as program element 4 states.

(d) Why CNS will monitor the FW nozzle only when the GALL Report recommends all high fatigue locations are monitored, not just at the most limiting location within the applicable NUREG/CR-6260 locations, as a minimum.

The staff notes that this RAI was originally issued as RAI B.1.15-3. Due to a subsequent revision after the RAI was transmitted to the applicant, the RAI was renumbered to RAI B.1.15-9, which superseded RAI B.1.15-3 for RAI tracking purpose.

In its response to RAI B.1.15-9(a), dated June 22, 2009, the applicant stated that the goals of the program do not include detecting aging effects. The applicant stated that, however, its AMP ensures the numbers of cycles assumed in the design basis fatigue analyses that include consideration of the effect of the reactor water environment remain valid, thereby preventing the effects of aging due to fatigue. The applicant further stated that the CNS program provides for periodic update of the number of cycles incurred by the plant and that the CNS program also provides update of the fatigue analyses if the incurred number of cycles is approaching the analyzed number.

Based on its review, the staff found the response to RAI B.15.1-9(a) acceptable because it is consistent with the guidance provided in NUREG-1801 Section X.M1, periodically updating the number of cycles and updating the fatigue analyses if the incurred number of cycles is approaching the analyzed number. Therefore, the concern identified in RAI B.1.15-9(a) is resolved.

In its response to RAI B.1.15-9(b), dated June 22, 2009, the applicant stated that the term “design cycle” is not limited to the cycles in USAR Table III-3-1, but includes the analyzed cycles in the fatigue analyses of record. The applicant also stated that its response to RAI B. 1.15-2 explains that CNS has added analyzed transients to the FMP as they have been identified. The applicant asserted that the FMP includes identified transients used as the basis for fatigue analyses to assure that the fatigue analyses remain valid.

Based on its review, the staff found the response to RAI B.15.1-9(b) reasonable because CNS added analyzed transients to the FMP as they have been identified to assure that the fatigue analyses remain valid. Therefore, the concern identified in RAI B.1.15-9(b) is resolved.

In its response to RAI B.1.15-9(c), dated June 22, 2009, the applicant stated that LRA Table 4.3-3 provides the results of analyses that project the CUFs for the locations identified in NUREG/CR-6260 for 60 years of operation including consideration of environmental effects. The applicant also stated that there is no analysis of environmentally assisted fatigue under the CLB and the effect on fatigue life of the reactor water environment is a new consideration for the period of extended operation. The applicant further stated that environmental fatigue analysis is not required during the initial 40 years of operation, consistent with the closure of Generic Safety Issue (GSI) 190. Furthermore, the applicant stated that upon receipt of a renewed license, these analyses become the analyses of record and at that time, CNS will revise the FMP to include the numbers of analyzed cycles (projected cycles) in the environmentally assisted fatigue analyses as acceptance criteria to assure that those analyses remain valid throughout the period of extended operation.

Based on its review, the staff found the response to RAI B.15.1-9(c) acceptable because CNS will revise the FMP, after receipt a renewed license, to include the numbers of analyzed cycles (which actually are the projected cycles) to assure that those analyses remain valid throughout the period of extended operation. Therefore, the concern identified in RAI B.1.15-9(c) is resolved.

In its response to RAI B.1.15-9(d), dated June 22, 2009, the applicant stated that the program is not limited to tracking only the cycles that affect the FW nozzle. The applicant also stated that the FMP at CNS counts the occurrence of design transients and compares the actual cycles incurred to the analyzed cycles for the applicable RCS components. The applicant further stated that the CNS FMP is not limited to certain specific components, but it covers all applicable RCS components.

Based on its review, the staff found the response to RAI B.15.1-9(d) acceptable because the FMP tracks all applicable reactor coolant system components. Therefore, the concern identified in RAI B.1.15-9(d) is resolved.

A clarification for program element 6, "acceptance criteria," was necessary. For program element 6, the onsite basis document, CNS-RPT-LRD02, Revision 1, stated that the FMP acceptance criteria are that none of the transients exceeded the allowable numbers in USAR Table III-3-1. However, the FMP acceptance statement does not mention that it has considered the environmental fatigue effects. Therefore, the staff issued RAI B.1.15-10, by letter dated June 8, 2009, requesting that the applicant to explain:.

(a) Parts (b) and (c) of RAI B.1.15-9 apply here. Please explain accordingly.

(b) Explain why FMP Element 6 does not mention environmental fatigue effects.

The staff notes that this RAI was originally issued as RAI B.1.15-4. Due to a subsequent revision after the RAI was transmitted to the applicant, the RAI was renumbered to RAI B.1.15-10, which superseded RAI B.1.15-4 for RAI tracking purpose.

In its response to RAI B.1.15-10(a), dated June 22, 2009, the applicant repeated the responses to RAI B.1.15-9 Parts (a) and (b), which have been accepted (above). The reason that the questions were repeated here was that FMP Element 6 also referred to USAR Table III-3-1. The inclusion of this portion in the current RAI is necessary to ensure completeness of the staff review.

In its response to RAI B.1.15-10(b), the applicant stated that the FMP will be enhanced to address the effect of the reactor water environment as stated in LRA Section B.1.15. The applicant also stated that this enhancement applies to Element 6, "acceptance criteria."

Based on its review, the staff found the response to RAI B.15.1-10(b) acceptable because FMP Element 6 will be consistent with the GALL Report after enhancement which considers the effects of reactor water environment. Therefore, the concern identified in RAI B.1.15-10(b) is resolved.

Under the program description of this program, the LRA states, "the program ensures the validity of analyses that explicitly assumed a fixed number of thermal and pressure transients by assuring that the actual effective number of transients does not exceed the assumed limit." The staff notes that the applicant relies on transient cycle monitoring to fulfill its FMP. However, there was no description or discussion regarding how CNS has been and will be monitoring the severity of pressure and thermal (P-T) activities during plant operations. It is essential that all thermal and pressure activities (transients) are bounded by the design specifications (including P-T excursion ranges and temperature rates). Furthermore, cycles of all significant thermal events should be captured and logged. Therefore, the staff issued RAI B.1.15-7, by letter dated May 1, 2009, requesting that the applicant:

(a) Describe the procedures that CNS uses for tracking thermal transients.

(b) Confirm that all monitored transient events are bounded by the design specifications.

(c) Specify the time (years) over which actual transient monitoring and cycle tracking activities took place.

(d) Provide a histogram of cycles accrued for normal start and normal shutdown transients.

In its response to RAI B.1.15-7(a), dated June 15, 2009, the applicant stated that CNS uses the thermal transient review procedure for tracking thermal transients. The applicant stated that this procedure requires CNS engineering to count all transients each fuel cycle and the procedure requires the review of plant operating data (initiator, temperatures, pressures, levels, etc.) and comparison of each transient to the transients defined in the design documents. The applicant further stated that the CNS Design Engineering Department management reviews each transient classification.

Based on its review, the staff found the applicant's response reasonable because the applicant provided the information requested and described the procedures and requirements for dealing with the captured transient data. Therefore, the concern identified in RAI B.1.15-7(a) is resolved.

In its response to RAI B.1.15-7(b), dated June 15, 2009, the applicant stated that the cycles counted in the thermal transient review procedure are compared against the transient definitions in the design documents and each event that occurred was counted as the next most severe transient that bounds that event so that the counted transients are bounded by those defined in the design specifications. The applicant further stated that the thermal transient review procedure requires additional actions if the parameters in design documents are exceeded. The applicant stated that under that circumstance, CNS would initiate a condition report as part of the corrective action program and evaluate using site QA procedures in accordance with 10 CFR 50 Appendix B.

Based on its review, the staff found the applicant's response reasonable because the applicant provided the information requested; described the method used to ensure the monitored transients are bounded by the design specification. Therefore, the concern identified in RAI B.1.15-7(b) is resolved.

In its response to RAI B.1.15-7(c), dated June 15, 2009, the applicant stated there have been no time periods for which transient data has not been accounted in the program. The applicant also stated that the initial transient review procedure was issued in the mid 1980s. Prior to the issuance of that procedure, the applicant explained that the plant logs and other documents were reviewed to determine the transients that had occurred.

Based on its review, the staff found the applicant's response acceptable because the applicant confirmed there have been no time periods throughout the plant operation history for which transient data has not been accounted. Therefore, the concern identified in RAI B.1.15-7(c) is resolved.

In its response to RAI B.1.15-7(d), dated June 15, 2009, the applicant provided the histogram of cycles accrued for normal startup and normal shutdown transients.

Based on its review, the staff found that the histogram received on June 15, 2009, contains insufficient information for the staff to perform a safety evaluation. The histogram covers merely 12 years, 1996 through 2007, although the plant has been in operation for 35 years, 1974 through 2009. For clarification, the staff held a teleconference call on September 29, 2009, requesting the applicant to provide a complete histogram that covers the entire plant operating history to date (through November 21, 2006 as indicated in the LRA Table 4.3-1). On October 8, 2009, the applicant provided new histograms which cover the entire history of the plant operation through 2007. Based on its review, the staff found inconsistencies between the accrued cycles shown in the histogram and the cycles reported in the LRA. Specifically, LRA Table 4.3-1 shows 181 cycles for normal startup. However, the histogram indicates that (through the end of 2006), the normal startup transient has occurred 183 ~184 times, approximately 3 cycles higher than what the LRA shows.

Furthermore, the histogram shows significantly larger number of cycles for the startup transient than for the shutdown transient, throughout the entire operating history. For example, as of the end of 2006 for the normal shutdown transient, the histogram shows 77 cycles accrued whereas LRA Table 4.3-1 reports 175 cycles. Clarification for all the inconsistencies described above is necessary. It is also necessary that the applicant provide the basis to support the use of the accrued cycles shown in LRA Table 4.3-1, where 181 cycles for the normal startup and 175 cycles for the normal shutdown are reported versus what the histogram shows, 184 and 77 cycles, respectively.

On January 14, 2010 the staff held a teleconference with the applicant discussing the areas that required further clarification. By letter dated March 25, 2010 the applicant supplemented its response to RAI B.1.15 7(d) by providing additional clarification regarding its histograms and the accrued cycles. The applicant stated that for the histogram, normal startups include all plant startups, however, many shutdowns are not normal shutdowns. The applicant clarified that some shutdowns were the result of transients or equipment malfunctions that were not included in the normal shutdowns shown on the histogram. The applicant stated if these transients were included as part of shutdown category, this would lead to counting the transient in the shutdown category and as part of the transient category. The staff noted that the method the applicant counts its transients is appropriate because the applicant has accounted for the transients that occur at its plant including all startups, all normal shutdowns and all shutdowns that occur based on equipment malfunctions or transients.

The applicant further provided additional information regarding plant operation for the initial years, stating that during the initial years of operation, there were more shutdowns that were caused for equipment issues and operator issues. The applicant further stated that the plant was also operating on 12-month refueling cycles that required a startup and shutdown every year. But, as more experience was gained, the number of equipment issues and operator errors decreased. The applicant provided the number of cycles for normal shutdowns, loss of feedwater shutdowns, turbine trips and other scrams in ten-year internals from 1974 through 1994, and further provided the same information for the time period between 1995 through 2009. The staff noted that with each successive interval the number of cycles for these transients decreased. The applicant stated that the more recent trend is expected to be representative of the future plant performance and that its Fatigue Monitoring Program will continue to track the number of plant transients so that fatigue analyses based on these number of cycles remain valid through the period of extended operation. The staff finds the use of the recent trend of operation to be representative of future plant performance reasonable because improved operating practices and experience have resulted in fewer transients due to equipment issues and operator issues and refueling cycles greater than 12-months.

Based on its review, the staff found the applicant’s response acceptable because (1) the applicant clarified and provided an appropriate basis for the discrepancy between the number of plant startup and shutdowns as described above and (2) the applicant provided its operating experience from the initial years of operation through 2009 and has demonstrated that recent trends in plant performance have improved since initial plant operation .Therefore, the concern identified in RAI B.1.15 7(d) is resolved.

Under the program description paragraph, LRA Section B.1.15, the applicant stated that the FMP will be enhanced to include assessment of the effects of reactor coolant environment on fatigue life of critical components. Analysis concerning the effects of reactor water environment on fatigue is provided in LRA Section 4.3.3. However, key information that will affect the assessments, such as strain rates, operating temperature, and chemistry of the reactor water, is not discussed in the LRA.

Therefore, the staff issued RAI B.1.15-8, by letter dated May 1, 2009, requesting that the applicant:

(a) Specify the analysis method(s) used for computing CUF for all Class 1 components, and clarify whether or not any of the CUF values shown in LRA were calculated using non-conforming software, FatiguePro, which considers only a single component of a stress tensor instead of all six stress components in accordance with the ASME Code Section III Design Code.

(b) Provide a summary of the F_{en} calculation for each structural component analyzed, including the values of DO level, temperature and strain rate used in the calculations.

(c) Describe the equation that was used for the time and water chemistry adjusted F_{en} calculations.

(d) Summarize CNS's experience in control of DO concentration in the reactor water since the plant startup. Describe all water chemistry programs CNS has used, including procedures and requirements used for managing DO concentration as well as the inception date of each water chemistry program.

(e) Describe the control parameters used to maintain and demonstrate chemistry control, and how the DO values vary with the expected and acceptable variations in these parameters.

(f) Describe how chemistry upset conditions have been considered in the F_{en} calculations.

In its response to RAI B.1.15-8(a), dated June 15, 2009, the applicant stated that none of the CUFs of record in the CLB were calculated using FatiguePro. The applicant also stated that stresses were typically calculated using finite element analysis considering six components of stress in accordance with the 1998 Edition, 2000 Addenda of the ASME Code, adjusted to account for Young's Modulus correction factor, and K_e factor where appropriate (the staff noted: Young's Modulus correction factor is defined as the ratio of the Young's Modulus at the temperature with which the S-N curve was established, to the Young's Modulus at the temperature based on which the analysis was made. K_e is plastic penalty factor, as defined in ASME III NB-3228.5: Simplified Elastic-Plastic Analysis).

Based on its review, the staff found the applicant's response acceptable because the applicant provided a description of the methodology for calculating the stresses and fatigue. The applicant also made adjustments in the fatigue calculations by applying the Young's Modulus correction factor and performed a simplified elastic-plastic analysis. The staff noted that both of these adjustments are necessary to achieve improved accuracy. Therefore, the concern identified in RAI B.1.15-8(a) is resolved.

In its response to combined RAI B.1.15-8(b) and (c), dated June 15, 2009, the applicant stated that for the environmental adjustment factor F_{en} calculations, the sulfur content, temperature, and strain rate were held constant at 0.015wt%, 550 ^{o}F, and 0.001%/s, respectively, and the equations used for the F_{en} calculations are those from NUREG/CR-6853 (Staff noted: it is 6583, rather) for carbon and low-alloy steels and NUREG/CR-5704 for stainless steels. The applicant provided the DO data individually for each component for the period under the NWC condition and the period under the HWC condition. Since CNS has been operating under two different water chemistry programs, the applicant calculated two F_{en} for each location, one based on the NWC condition, and one based on the HWC condition. With these two F_{en} sets, the applicant calculated an equivalent F_{en} value, for each location, to be used to determine the overall environmental effects. The equivalent F_{en} is a weighted average quantity, calculated in accordance with the duration in which the NWC and HWC were in effect (49.1 percent under HWC and 50.9 percent under NWC over a total of 60 years of plant life). In its response to this RAI, the applicant also presented an augmented LRA Table 4.3-3 to include individual DO data applicable to each NUREG/CR-6260 location during the NWC period and during the HWC period.

Based on its review, the staff found the applicant's response acceptable because the applicant provided the information requested on DO levels, sulfur concentration, temperatures, and strain rates required for F_{en} calculations. The staff notes that the weighting factors of 49.1 percent for HWC and 50.9 percent for NWC that the applicant calculated reflect the time period in which the HWC program and NWC program, respectively, were in effect. Based on the CNS plant start-up date, January 18, 1974, and the end of NWC program date, August 2003 as indicated in the applicant's response to RAI B.1.15-8(d) below, the staff determined that there are 29 years and 6 months, approximately, in which the NWC was in effect. This means that 49.1 percent of the 60 years the plant was under the NWC condition, slightly deviated from the applicant provided 50.9 percent. It appears that the applicant has the HWC and NWC coverage periods transposed. However, a discrepancy of such a small magnitude is negligible. In general, the concern identified in RAI B.1.15-8(b) and (c) is resolved.

In its response to RAI B.1.15-8(d), dated June 15, 2009, the applicant summarized the chemistry programs used at CNS and provided data of DO concentration for the periods when the plant was operating under the NWC condition and the period under the HWC condition. The applicant stated that during the HWC period, a specified amount of hydrogen was injected into FW to neutralize the DO. The applicant stated that numerous measurements were made using the RR/RWCU inlet sample point and confirmed that these measurements were consistent with the approximately 150 to 180 parts per billion (ppb) DO value expected using NWC. During the HWC period, the DO concentration was reduced to 3 ppb, approximately.

The applicant stated that all measurements that have been made were taken on the RR/RWCU inlet sample point. To determine the DO for locations inside the reactor vessel, the applicant utilized the BWRVIP Radiolysis Model. Applying this model to the NWC period, the applicant determined the DO level in the internal reactor vessel locations ranging between 90 ppb and 120 ppb, which compared well with the RR/RWCU inlet sample point reading, 120 ppb. Applying the BWRVIP Radiolysis Model to the HWC period, the applicant calculated the DO level in the reactor vessel ranging between 4 ppb (at the RR/RWCU inlet sample point) and 90 ppb (in the upper plenum), approximately.

Based on its review, the staff found the applicant's response reasonable because the applicant has provided the information requested on the reactor water management programs and the applicant has summarized the OE. For the NWC period, the measured DO level agrees well with what the BWRVIP Radiolysis Model predicted. For the HWC period, the BWRVIP Radiolysis Model predicted a fairly wide range of DO in the reactor vessel, between 4 ppb and 90 ppb. However, the staff notes that as far as the RR/RWCU inlet sample point is concerned, the BWRVIP Radiolysis Model predicted DO level and the direct measurement closely correspond. For the upper plenum location, however, there was no measurement available for comparison. It is the staff's belief that the BWRVIP Radiolysis Model is able to produce good results. In its response to RAI B.1.15-8(b) and (c), the applicant provided individual DO data for each location during both the NWC and HWC periods, as mentioned above and the equivalent F_{en} values were calculated based on these data. Therefore, the concern identified in RAI B.1.15-8(d) is resolved.

In its response to combined RAI B.1.15-8(e), dated June 15, 2009, the applicant described the control parameters used to maintain chemistry controls. The applicant stated that the DO concentration in the reactor is a function of temperature and pressure. During the HWC period, the DO concentration is controlled by the injection of hydrogen. The applicant stated that at the time of the initial injection of hydrogen, a ramp test was performed to determine the amount of hydrogen necessary to reduce the electrochemical corrosion potential (ECP) to a value low enough to suppress IGSCC. Once the minimum hydrogen injection value was determined, additional hydrogen flow was added to provide margin and the final hydrogen flow rate into FW was established at 7.5 scfm (standard cubic feet per minute). The applicant further stated that the hydrogen injection flow rate is the only control parameter utilized but chemistry records the hydrogen flow rate as well as the calculated ECP. The radiolysis model is responsible for confirming that the H_2 to O_2 molar ratio is greater than 2 at locations within the reactor and these measurements track and confirm that the appropriate amount of hydrogen is added.

Based on its review, the staff found the applicant's response reasonable because the applicant has provided the information requested and described the chemistry control procedures. Therefore, the concern identified in RAI B.1.15-8(e) is resolved.

In its response to combined RAI B.1.15-8(f), dated June 15, 2009, the applicant stated that chemistry upsets were not considered in the calculation of F_{en} for the environmental fatigue analyses. The applicant stated that the chemical conditions in the vessel do not change rapidly and chemistry upsets are not significant to fatigue if no design transient occurs during the chemistry upset.

Based on its review, the staff found the applicant's response reasonable because the applicant explained that chemistry upset usually does not occur and chemistry upset would not affect fatigue life of components if no design transient occurs during the chemistry upset. The staff found the applicant's response acceptable because the chance is very low for a transient and chemistry upset to occur simultaneously. Therefore, the concern identified in RAI B.1.15-8(f) is resolved.

Enhancements. The applicant presented two enhancements in LRA Section B.1.15. The first enhancement pertains to program elements 2, 4, 6, and 7, "preventive actions," "detection of aging effects," acceptance criteria," and "corrective actions." The applicant stated that the CNS FMP will be enhanced to manage the effect of the reactor water environment on fatigue life by means of one or more of the following options:

(a) Updating the fatigue usage calculations using refined fatigue analyses to determine valid CUFs less than 1.0 when accounting for the effects of reactor water environment. (This includes applying the appropriate F_{en} factors to valid CUFs determined using an NRC-approved version of the ASME Code or NRC-approved alternative [e.g., NRC-approved code case]).

(b) Repairing or replacing the affected locations before exceeding a CUF of 1.0.

The staff notes that, pursuant to GSI-190, applicants should address the effects of coolant environment on component fatigue life as AMPs are formulated in support of license renewal. The staff found relating the proposed enhancement to program element 2, “preventive actions;” element 4, “detection of aging effects;” element 6, “acceptance criteria;” and element 7, “corrective actions,” reasonable because of the following reasons: (1) Monitoring the effect of reactor water on fatigue is a form of preventive action, preventing structural failure by maintaining the fatigue usage below the limit, (2) The aging effects are magnified due to increased aggressiveness of the environment and the aging effects can be detected by updating the fatigue usage, (3) The environmental effect amplifies fatigue usage factor and that will affect the acceptability of fatigue analysis, and (4) The environmental effects promote fatigue crack initiation and growth and that can affect the way of handling the corrective actions (e. g., corrective actions may now include considering improved environments, selecting a more corrosion resistant material for replacement, searching for more accurate analytical methods, etc.). With this enhancement, the FMP becomes consistent with the GALL Report AMP. It also provides reasonable assurance that the intended functions of the components will be maintained during the period of extended operation.

The second enhancement pertains to program element 3, “parameters monitored or inspected.” The applicant stated: “The CNS Fatigue Monitoring Program will be enhanced to require the recording of each transient associated with the actuation of a safety/relief valve (SRV).” The staff found including this enhancement appropriate because actuation of a safety/relief valve will induce a transient that will affect the primary containment, as discussed and evaluated in LRA Section 4.6. The staff also found relating this enhancement program to element 3 acceptable because this is a new parameter incorporated into the FMP.

Operating Experience. The staff also reviewed the OE described in LRA Section B.1.15. The CNS Fatigue Monitoring Program, B.1.15 made no mention of industry OE of any kind. The only OE presented, concerns transient cycle tracking of CNS’s own plant. Therefore, a clarification of “operating experience,” program element 10, is necessary to ensure thoroughness of the applicant’s handling of this program element. The staff issued RAI B.1.15-5, by letter dated May 1, 2009, requesting that the applicant address the following issues:

(a) Describe the documents that CNS has reviewed in considering the industry OE on metal fatigue and provide the corresponding followup actions taken by CNS.

(b) List industry experiences which have been incorporated into the CNS Fatigue Monitoring Program.

In its response to RAI B.1.15-5(a), dated June 15, 2009, the applicant stated that CNS has reviewed NRC documents (INs, bulletins, regulatory issue summaries, and RGs); vendor notices; NEI; Institute of Nuclear Power Operations (INPO); EPRI documents; and other utility LRAs. Specific documents include RIS 2008-30, NUREG/CR-6260, GE notices on FW cycling, and recent LRAs. Based on its review, the staff found the applicant’s response appropriate because it covers essentially all sources that discuss concerns about plant operations.

In its response to RAI B.1.15-5(b), dated June 15, 2009, the applicant stated that industry experience incorporated into the CNS FMP includes the following:

- Environmental effect analyses, that have been performed for license renewal and ongoing activities prescribed by the FMP, include consideration of environmental effects.

- In response to GE vendor notices, which identified FW cycling phenomena during plant operation, NPPD revised FW nozzle fatigue analyses to account for this phenomenon.

In addition, the applicant stated that NPPD is aware of the issue identified in NRC RIS 2008-30 concerning the non-conforming analysis method used for fatigue usage calculation. The applicant stated that, since NPPD did not use that method for any environmental-assisted fatiguing (EAF) fatigue analyses, no changes to the CNS program were required.

Based on its review, the staff found the response to RAI B.15.1-5(b) acceptable because (1) CNS FMP has included evaluations of the effects of reactor water environment on fatigue life; and (2) NPPD has revised FW nozzle fatigue analyses to account for the FW cycling phenomena as shown in LRA Section 4.3.1.2. Therefore, the concern identified in RAI B.1.15-5(b) is resolved.

During the onsite audit, the staff reviewed Engineering Procedure 3.20 and transient tracking records. Engineering Procedure 3.20 provides for collection of RPV operational transients, as implemented by the FMP. However, Engineering Procedure 3.20 does not provide criteria defining “a transient.” Therefore, the staff issued RAI B.1.15-6, by letter dated May 1, 2009, requesting that the applicant address the following issues:

(a) The record for 2003 states that on December 2, 2002, the SCRAM “is not recorded as a transient.” What were the thermal and pressure characteristics of this SCRAM and why was it not identified as a transient?

(b) The record for 2003 also identifies a new transient on April 20, 2000.

- Why was this transient not identified as contemporaneous with its occurrence? If this were due to a redefinition of conditions that qualify as a transient, were there other newly identified transients?
- What corrective actions were implemented to ensure that future transients would not be missed?

In its response to RAI B.1.15-6(a), dated June 15, 2009, the applicant stated that the SCRAM that occurred on December 2, 2002 was a manual SCRAM during start-up. The applicant further stated that, since there was no significant impact on the vessel temperature or pressure, per Attachment 3 of Procedure 3.20, temperature changes less than or equal to 25 °F or pressure changes less than or equal to 50 psig are considered insignificant.

Based on its review, the staff found the applicant’s response acceptable because of the following reasons: (1) a temperature change of less than 25 °F will induce less than 8 ksi in thermal stress for steels, which is lower than the endurance limit of carbon and low alloy steels shown in the ASME Code design S-N curve, Figure I-9.1 and for stainless steels shown in the ASME Code Figure I-9.2.1, (2) and changes in pressure less than 50 psig will produce less than 1 ksi in hoop stress for almost all pressure vessels and piping designs. Therefore, the concern identified in RAI B.1.15-6(a) is resolved.

In its response to RAI B.1.15-6(b), dated June 15, 2009, the applicant stated this thermal event was associated with a warming up preparation for the ASME Code Section XI pressure test with

RR Loop A in service at 200 °F. The applicant also stated that when the RR Loop B reactor recirculation pump was started the coolant temperature in RR Loop B went from 80 °F to 200 °F in 30 minutes. The applicant further stated although RR Loop B temperature changed, the vessel temperature readings remained between 150 °F and 200 °F during this period. The applicant concluded that since the temperatures were on the permissible side of the P-T curve and the RV was vented during this event (there was no pressure increase), this condition did not exceed the minimum vessel metal temperature limits specified in the Technical Specification and as such was not a counted as a transient.

As for the concern on corrective actions taken, the applicant stated in the response to RAI B.1.15-6 that this event was not identified as a transient by operations when it occurred. The applicant also stated that it was identified later during review of the last two performances of the RV ASME Section XI pressure test. The applicant stated that no program modification was necessary because the event was correctly handled by the existing procedure.

Based on its review, the staff found the applicant's response acceptable because the thermal event in question did not exceed the P-T curve limits, so no additional cycle should be accumulated against this particular pressure test operation. Although the event in question was not identified as a transient when it occurred, it was identified as one later through a technical review. Therefore, a corrective action and a program modification are deemed unnecessary. As such, the concern identified in RAI B.1.15-6(b) is resolved.

USAR Supplement. In LRA Section A.1.1.15, the applicant provided the USAR supplement for the FMP. The staff also verified that in Commitment No. NLS2008071-08 the applicant has committed to the enhancements of the program which will be implemented prior to the period of extend operation. The staff reviewed USAR) supplement and determined that the information in the USAR supplement is an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's FMP, including the applicant's responses to the RAIs, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation, prior to the period of extended operation through Commitment No. NLS2008071-08, would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

3.0.3.2.11 Fire Protection Program

Summary of Technical Information in the Application. LRA Section B1.16 describes the existing Fire Protection Program as consistent, with an exception and six enhancements, with the GALL AMP XI.M26, "Fire Protection." The applicant stated that its Fire Protection Program consists of inspections of the fire barriers and the diesel-driven fire pump. The fire barrier inspections include periodic visual inspections for the fire barrier penetration seals, fire dampers, fire stops, fire wraps, fire barrier walls, ceilings, floors, and fire rated doors. The diesel-driven fire pump inspection calls for the periodic testing of the fire pump and inspections of the fuel supply lines. The applicant further stated that the periodic testing and inspection of the Halon and CO_2 fire suppression systems are also part of the Fire Protection Program.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The staff reviewed the exception and enhancements to determine whether the AMP, with the exception and enhancements, is adequate to manage the aging effects for which the LRA credits it.

In comparing the elements in the applicant's program to those in the GALL AMP XI.M26, the staff determined that the program elements, for which the applicant claimed consistency with the GALL Report, were consistent. The GALL Report recommends a fire hazard analysis (FHA) be performed to assess the fire potential and fire hazards in all plant areas. The staff verified that the applicant's plant-wide FHA covered the fire potential and fire hazards in the plant. The GALL Report also recommends a visual examination of approximately 10 percent of the seals at least once every RFO. The staff verified that the applicant visually inspects all accessible seals during plant operation. The inaccessible seals are inspected during the scheduled RFO to minimize personnel radiation exposure. Table 3.5.2-4 of the LRA, page 3.5-89, includes fire wrap (made of Cerafiber and cera-blanket) as a fire barrier. Although fire wrap is not specifically included in the GALL AMP XI.M26, the applicant nevertheless visually inspects its fire wrap as a part of fire barrier inspections as described in the LRA fire barrier section LRA B.1.16. Through on-site document reviews and interviews with the applicant's technical staff, the staff confirmed that the applicant's fire protection AMP contains all of the program elements referenced in the GALL Report.

The staff reviewed the exception to determine whether or not the applicant's AMP, with the exception, is adequate to manage the aging effects through the period of extended operation.

Exception. LRA Section B.1.16 states an exception to the "parameters monitored/inspected" and "detection of aging effects" program elements as the applicant stated that it will functionally test the Halon and CO_2 fire suppression systems on an 18-month cycle, with visual inspection of the systems on a 6-month cycle. The GALL Report recommends that a visual and function test be performed on the Halon and CO_2 fire suppression systems at least once every six months. Therefore, in RAI B.1.16.1, dated May 1, 2009, the staff asked the applicant to provide justification as to why the 18-month basis is sufficient to protect the Halon and CO_2 fire suppression systems. In its response to RAI B.1.16.1, dated June 15, 2009, the applicant provided the following discussion: "Inspection and testing frequencies for the CO_2 and Halon fire protection systems are specified in the approved CNS Technical Requirements Manual."

The staff reviewed the applicant's response and noted that the applicant's CLB is to functionally test the systems on an 18-month cycle. The 18-month cycle specified was part of the original licensing basis until the fire protection limiting condition for operation and surveillance requirements were removed from the technical specification based on GL 88-12, "Removal of Fire Protection Requirements from Technical Specifications," dated August 2, 1988, and placed in the plant TRM. The Halon and CO_2 systems installed at CNS is based on the National Fire Protection Association (NFPA) 12 A, Code of Record "Standard on Halon 1301 Fire Extinguishing Systems," 1980 Edition,, and NFPA 12, Code of Record "Standard on Carbon Dioxide Extinguishing Systems," 1973 Edition, respectively. The NFPA 12 A and 12 did not specify any testing frequency for the Halon and CO_2 fire suppression systems. The staff verified that the surveillance and testing frequency for the Halon and CO_2 fire suppression systems in the GALL Report is based on the current NFPA 12A code (2009) and the NFPA "Fire Protection Systems – Inspection, Test & Maintenance Manual," 2nd Edition, 1994, respectively.

The staff noted that the externals of the applicant's fire suppression systems and components are exposed to an inside air environment. The staff's review of CNS OE indicated no aging-related event that has adversely affected the operation of the fire suppression systems. Therefore, the 18-month functional testing period is reasonable to manage the aging effects.

Based on the review of the applicant's plant-specific experience, the staff finds the 18-month cycle is adequate as far as aging management is concerned. Therefore, the staff considers the exception acceptable.

Enhancement 1. LRA Section B.1.16 states an enhancement of observing the diesel fire pump engine subcomponents during engine operation to the "parameters monitored/inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements. No degradation (e.g., excessive fuel oil or exhaust gas leakage) will be acceptable.

The GALL Report recommends observing the diesel-driven fire pump during testing for signs of degradation of the fuel supply line. In reviewing this enhancement, the staff noted that the wording in the applicant surveillance procedure did not require the operator to observe signs of degradation while the engine was running. This enhancement directs the operator to look for signs of degradation as recommended in the GALL Report. Therefore, the staff finds the applicant's enhancement acceptable because it will make the applicant's program consistent with GALL AMP XI.M26.

Enhancement 2. LRA Section B.1.16 states an enhancement of inspecting the diesel fire pump engine carbon steel exhaust components for corrosion or cracking to the "parameters monitored/inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements. The frequency is at least once every five years.

In reviewing this enhancement, the staff noted that the GALL Report only has a general recommendation of checking the diesel engine fuel line for degradation. It does not have a specific recommendation on the corrosion inspection of the fire pump diesel engine exhaust components. As discussed in the audit report, this enhancement should improve the applicant's inspection program in a general manner because it adds a corrosion inspection to the existing program. Therefore, the staff concludes that the enhancement was acceptable because it goes above the GALL AMP XI.M26 recommendation.

Enhancement 3. LRA Section B.1.16 states an enhancement of visually checking the fire damper framing for signs of degradation to the "parameters monitored/inspected," "detection of aging effects," and "monitoring and trending," program elements.

In reviewing this enhancement, the staff noted that, while the GALL Report recommends inspecting dampers for possible damage, it does not single out damper framing as a separate inspection activity. At the present time, the applicant's inspection program includes the inspection of the damper assembly. However, the inspection does not identify the fire damper framing as an item of inspection. The staff noted that calling the operator's attention to fire damper framing integrity contributes to the overall soundness of the fire damper assembly. The staff reviewed this enhancement and finds the applicant's enhancement acceptable because it goes beyond the GALL AMP XI.M26 recommendation.

Enhancement 4. LRA Section B.1.16 states an enhancement of visually inspecting the Halon and CO_2 fire suppression systems for signs of degradation to the "parameters monitored/inspected," "detection of aging effects," and "monitoring and trending," program elements. The frequency is at least once every six months.

The GALL Report recommends the Halon and CO_2 fire suppression systems be visually inspected at least once every six months. In reviewing this enhancement, the staff noted that the applicant periodically inspects its Halon and CO_2 systems. However, applicant's current procedures do not specifically direct the operator(s) to look for signs of degradation. With this enhancement, the applicant's program will be in line with the GALL Report guidelines.

The staff finds the applicant's enhancement acceptable because it will make the applicant's program consistent with GALL AMP XI.M26.

Enhancement 5. LRA Section B.1.16 states an enhancement of inspecting the cardox hose reels for corrosion to the "parameters monitored/inspected," and "acceptance criteria" program elements.

The cardox hose reels are part of the low pressure CO_2 system. The GALL Report recommends the material conditions of the Halon and CO_2 systems be inspected for signs of degradation (e.g., corrosion). In reviewing this enhancement, the staff noted that while the applicant periodically inspects the low pressure CO_2 system, the hose reels of the CO_2 cardox system were not specifically being inspected for corrosion. Therefore, this enhancement brings the applicant's program in line with the GALL Report recommendation.

The staff finds the applicant's enhancement acceptable because it will make the applicant's program consistent with GALL AMP XI.M26.

Enhancement 6. LRA Section B.1.16 states an enhancement of visually inspecting the concrete floor curbs, manways, hatches, and hatch covers for signs of degradation to the "detection of aging effects" program element. The frequency is to be once every 18 months.

The GALL Report recommends the inspection of fire barriers (i.e., penetration seals, fire barrier walls, ceilings, floors, and fire-rated doors). In particular, approximately 10 percent of the penetration seals are to be inspected once every RFO. In reviewing this enhancement, the staff noted that some of the items identified in this enhancement did not have a fire barrier function. For instance, flood curbs prevent liquid leaks from moving outside the point of origin. Others may impede the spread of fire if they are part of the fire barrier. These items do not receive regular inspections at the present time. Subjecting these items to periodic inspection should help protect them from possible degradation in the future, thereby meeting the intent of the GALL Report recommendation of regularly inspecting fire barriers.

The staff finds the applicant's enhancement acceptable because it will make the applicant's program consistent with GALL AMP XI.M26.

Operating Experience. The staff also reviewed the OE described in LRA Section B1.16. The applicant provided several examples of recent operating history of the fire protection systems in this section. For instance, the applicant found the as-is condition of certain fire barriers unsatisfactory during inspections between 2002 and 2006. The unsatisfactory conditions ranged from a fire door being left open, to fire seals having voids. Likewise, excessive gaps between the fire door and its frame were also found through regular inspections. In instances where unsatisfactory conditions were discovered, corrective actions were taken by the applicant to rectify the particular condition(s).

The staff also reviewed the applicant's fire inspection records and verified that inspections of the fire barriers (including fire wrap, doors, and, in one case, fire proofing material taking credit as part of the overall fire barrier), fire water pumps, and gaseous fire suppression systems had been properly carried out in accordance with the plant procedures. In addition, the staff also conducted an independent search of the applicant's OE database. The majority of the OE indicated two types of defects: (1) fire seals of questionable condition due to wear and tear or other age-related phenomena; and (2) fire doors that were out-of-spec (e.g., doors that could not be fully closed and/or latched or had evidence of corrosion, etc).

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.

USAR Supplement. In LRA Section A1.1.16, the applicant provided the USAR supplement for the fire protection program. The staff reviewed the regulatory commitments listed in a letter from the applicant to the NRC dated September 24, 2008, and verified that the six enhancements laid out in Section A1.1.16 had been included as Commitment No. 9 (NLS2008071-09).

The staff determines that the information in the USAR is an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's fire protection program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and determined that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. Also, the staff reviewed the enhancements and confirmed that their implementation through Commitment NLS2008071-09 prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

3.0.3.2.12 Fire Water System Program

Summary of Technical Information in the Application. LRA Section B.1.17 describes the existing Fire Water System Program as consistent, with two exceptions and four enhancements, with GALL AMP XI.M27, "Fire Water System." The applicant stated that the fire water systems consist of sprinklers, nozzles, fittings, valves, hydrants, hose stations, standpipes, and aboveground and underground piping and components that are tested and inspected in accordance with the applicable NFPA codes and standards. The applicant further stated that, in order to detect corrosion, the fire water systems undergo periodic flushing and system performance testing and inspections.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The staff reviewed the exceptions and enhancements to determine whether the AMP, with the exceptions and enhancements, is adequate to manage the aging effects for which the LRA credits it.

In comparing the elements in the applicant's program to those in GALL AMP XI.M27, the staff determined that those program elements for which the applicant claimed consistency were consistent. Through on-site document reviews and interviews with the applicant's technical staff, the staff confirmed that the applicant Fire Water System contains all the program elements referenced in the GALL Report.

The staff reviewed the exceptions to determine if the applicant's AMP, with the exceptions, is adequate to manage the aging effects through the period of extended operation.

Exception 1. LRA Section B.1.17 states an exception to the "detection of aging effects" program element:

> NUREG-1801 recommends annual fire hydrant hose hydrostatic tests. However, the hoses are not subject to aging management since they are periodically inspected, hydrotested, and replaced.

As stated in NUREG-1800 Table 2.1.3 Revision 1, fire hoses are considered category (d) consumables, and are subject to replacement based on NFPA standards and plant procedures. Therefore, they may be excluded from the AMR on a plant-specific basis. According to the applicant, the applicant visually inspects all fire hoses on a monthly basis. In addition, the indoor hoses are hydrotested on a triennial basis. The outdoor hoses are hydrotested on an annual basis. The hydrotesting is conducted by an offsite vendor and undergo visual examination during hydrotesting. Defective hoses are removed from service.

Based on the review of the applicant's current hose inspection frequency and classification of fire hoses as category (d) consumables, the staff finds exempting the hoses from aging management a reasonable approach because category (d) consumables are exempt from an AMR. Therefore, the staff considers the exception acceptable.

Exception 2. LRA Section B.1.17 states an exception to the "detection of aging effects" program element:

> NUREG-1801 recommends annual gasket inspections. However, the gaskets are not subject to aging management since they are periodically inspected, and replaced.

The staff reviewed NUREG-1800 Table 2.1.3 Revision 1, and confirmed that gaskets are considered category (a) consumables. Therefore, they are replaced on an as-needed basis, and can be excluded from the AMR. Gaskets are included as part of the fire hose station examination.

Based on the review of the applicant's plant records and classification of the gaskets, the staff finds exempting the gaskets from aging management a reasonable approach because they are consumables replaced on an as-need basis. Therefore, the staff considers the exception acceptable.

Enhancement 1. LRA Section B.1.17 states an enhancement to the "parameters monitored/inspected," and "acceptance criteria" program elements:

> The Fire Water System Program will be enhanced to include inspection of hose reels for corrosion. Acceptance criteria will be enhanced to verify no acceptable corrosion.

In reviewing this enhancement, the staff noted that the applicant currently inspects the fire hose reels in accordance with plant-specific procedures. However, the procedures did not specifically point out corrosion as an area of inspection. This enhancement clarifies the wording in the procedure and improves maintenance of the fire hose reels.

The GALL Report recommends annual inspection of fire hydrants and associated equipment to ensure timely detection of degradation. The staff finds the applicant's enhancement acceptable because it will make the applicant's program consistent with GALL AMP XI.M27.

Enhancement 2. LRA Section B.1.17 states an enhancement to the "parameters monitored/inspected," and "acceptance criteria" program elements:

> The Fire Water System Program will be enhanced to include visual inspection of spray and sprinkler system internals for evidence of corrosion. Acceptance criteria will be enhanced to verify no acceptable corrosion.

The GALL Report recommends monitoring the internal system corrosion conditions to ensure the system maintains its intended function. The applicant's proposed enhancement to inspect the piping internals for corrosion aligns the fire water piping inspection with the GALL Report recommendation.

The staff finds the applicant's enhancement acceptable because it will make the applicant's program consistent with GALL AMP XI.M27.

Enhancement 3. LRA Section B.1.17 states an enhancement to the "parameters monitored/inspected," and "detection of aging effects" program elements:

> Wall thickness evaluations of fire protection piping will be performed on system components using non-intrusive 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.

The GALL Report recommends that wall thickness evaluations of fire protection piping be performed with non-intrusive techniques to identify evidence of loss of material due to corrosion.

Furthermore, the GALL Report recommends the inspections be performed before the end of the current operating license, and at plant-specific intervals thereafter, during the period of extended operation.

The staff finds the applicant's enhancement acceptable because it will make the applicant's program consistent with GALL AMP XI.M27.

Enhancement 4. LRA Section B.1.17 states an enhancement to the "parameters monitored/inspected," and "detection of aging effects" program elements:

> A sample of sprinkler heads required for 10 CFR 50.48 will be tested or replaced using guidance of NFPA-25 (2002 edition), Section 5.3.1.1.1, before the end of the 50-year sprinkler head service life and at 10-year intervals thereafter during the extended period of operation.

The GALL Report recommends following NFPA 25 (2002) to either replace the sprinklers or test a representative sample of the sprinklers once the sprinklers reach their 50-year service life. Additionally, according to NFPA 25, the same procedure should be repeated at a 10-year interval following the initial testing.

The staff finds the applicant's enhancement acceptable because it will make the applicant's program consistent with GALL AMP XI.M27.

Operating Experience. The staff also reviewed the OE described in LRA Section B.1.17. The applicant stated that it had discovered evidence of MIC in one of its fire water piping in 2002 (Ref: NPPD Notification 10175383, RCR 2002-1258) while performing inspection of a clapper valve (a check valve) on a pre-action sprinkler system in the control bldg electrical cable spreading room. From the lab analysis the applicant concluded that the MIC nodules were old ones (i.e., not active nodules). As such, the applicant stated that no biocide was added to the piping system, but the affected section of the valve was replaced. The applicant planned to continue looking for evidence of MIC every time it tested the pre-action systems per plant procedures. In addition, the applicant stated that, given the high purity of its normal source of fire water (treated by a set of reverse osmosis (RO) units), the only source of biological contamination was through the river water. To reduce the likelihood of inadvertent introduction of river water into the fire water tanks in the future, the applicant intends to remove the auto-start function of the only fire water pump that is capable of pumping river water from the Missouri River directly into the fire water storage tanks. Furthermore, the applicant intends to procedurally require that the fire water system be flushed once river water is allowed into the fire water storage tanks. The staff reviewed the applicant's current practice and proposed upgrades and concludes that, collectively, these upgrades should effectively reduce the likelihood of microbiological intrusion into the fire water system, thereby minimizing the MIC of the fire water system.

The staff also reviewed the plant records and verified that the applicant has indeed performed the tests and inspections (e.g., the annual inspections and flow tests on the yard fire hydrants, flow and hydrostatic testing, etc.) as recommended in the GALL Report.

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 LRA program element acceptable.

USAR Supplement. In LRA Section A1.1.17, the applicant provided the USAR supplement for the Fire Water System Program. The staff reviewed the regulatory commitments listed in Attachment 3 of a letter from the applicant to the NRC dated September 24, 2008, and verified that the four enhancements (i.e., inspection of hose reels for corrosion, inspection of spray/sprinkler internals for corrosion, fire piping wall thickness evaluation, and replacing/testing of sprinkler heads.) stated in Section A1.1.17 had indeed been included as commitment No. 10 (NLS2008071-10).

The staff determines that the information in the USAR supplement is an adequate summary description of the program, in accordance with 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 exceptions and their justification and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits it. Also, the staff reviewed the enhancements and confirmed that their implementation through Commitment NLS2008071-10 prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant 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, in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

3.0.3.2.13 Flow-Accelerated Corrosion Program

Summary of Technical Information in the Application. LRA Section B.1.18 describes the existing Flow-Accelerated Corrosion Program as consistent, with an exception and an enhancement, with GALL AMP XI.M17, “Flow-Accelerated Corrosion.” The applicant described the program as being applicable to both safety-related and nonsafety-related carbon steel components and gray cast iron in systems carrying single-phase and two-phase high-energy fluid greater than or equal to two percent of plant operating time. According to the applicant, the program, based on EPRI guideline Nuclear Safety Analysis Center (NSAC)-202L, “Recommendations for an Effective Flow Accelerated Corrosion Program,” predicts, detects and monitors flow-accelerated corrosion in plant piping and other pressure retaining components. The systems within the scope of this program include, but are not limited to, main, exhaust and auxiliary steam (AS), extraction steam, condensate and FW, heater drains, and miscellaneous drains, vents and seal systems.

Staff Evaluation. During its audit and review, the staff confirmed the applicant’s claim of consistency with the GALL Report. The staff reviewed the exception and enhancement to determine whether or not the AMP, with the exception and enhancement, is adequate to manage the aging effects for which the LRA credits it.

According to GALL AMP XI.M17, “Flow-Accelerated Corrosion,” the general guidelines for a Flow-Accelerated Corrosion Program are provided in NSAC-202L, Revision 2. This includes procedures or administrative controls to assure that the structural integrity of all carbon steel lines containing high-energy fluids is maintained. Based on its review of the applicant’s documentation, the staff could not determine if the flow-accelerated corrosion program used the guidance from NSAC-202L Revision 2. The applicant’s reference to “lessons learned and new technology that became available after the publication of NSAC-202L, Revision 1,” implies that portions of the program may not be consistent the guidance in Revision 2.

In order to resolve this concern, in RAI B.1.18-1 dated May 1, 2009, the staff requested that the applicant address whether or not all elements of the flow-accelerated corrosion program will implement the guidance of NSAC-202L, Revision 2 or later. In its response dated June 15, 2009, the applicant stated with the enhancement in LRA Section B.1.18, the program will be consistent with the NUREG-1801 program and will ensure that the elements within the Flow-Accelerated Corrosion Program will implement the guidance of NSAC-202L, Revision 2. The staff finds this acceptable because the enhanced program will be consistent with the GALL Report. The staff’s concern described in RAI B.1.18-1 is resolved.

With regard to the “scope of program” program element, the applicant’s description of the program appears to restrict its applicability to systems that only operate greater than or equal to two percent of plant operating time. According to the applicant this is in accordance with the criteria given in NSAC-202L, however, the staff found no such operational restriction in GALL AMP XI.M17. Furthermore, the staff noted that, immediately following the cited operational criteria in NSAC-202L, there is a cautionary statement concerning severe operating conditions. This caution advised against excluding systems based on operating time alone and specifically noted that some lines operating less than two percent of the time have experienced damage caused by flow-accelerated corrosion.

In order to resolve this concern, the staff issued RAI B.1.18-2, by letter dated May 1, 2009, requesting that the applicant provide justification for excluding systems from the scope of the FAC Program that operate less than two percent of the time and to describe how the associated caution statements in NSAC-202L will be addressed. The applicant responded to RAI B.1.18-2, by letter dated June 15, 2009, stating that the CNS program does not exclude systems from evaluation based on operating time alone. The applicant also revised the program descriptions in LRA Section A.1.1.18 and Section B.1.18, as documented in Attachment 2, Item 11 of the above response, to delete the phrase "greater than or equal to two percent of plant operating time." The staff finds this acceptable because the applicant removed the restriction from the program description, making it consistent with the GALL Report. The staff's concern described in RAI B.1.18-2 is resolved.

The staff noted that an additional aspect of the “scope of program” program element pertains to the applicant's statement that this program applies to carbon steel components and gray cast iron in certain systems. Although clearly applicable to carbon steel components, the staff noted that NSAC-202L does not have any discussion regarding gray cast iron. Since it could not be confirmed by the staff, that the material library for the program's predictive plant model includes gray cast iron, it was unclear to the staff how this AMP would be used to effectively manage the relevant aging effects for this material.

In order to resolve this concern, the staff issued RAI B1.18-6, dated October 7, 2009, requesting that the applicant explain how it intends to effectively manage the relevant aging effects for gray cast iron through the Flow-Accelerated Corrosion Program. The RAI also requested relevant OE related to gray cast iron. The applicant responded to RAI B.1.18-6, by letter dated November 4, 2009, stating that the program manages the loss of material for nonsafety-related steam traps and valve bodies made from gray cast iron in the auxiliary steam system. The applicant further stated that these components are included in the Flow-Accelerated Corrosion Program as “susceptible non-modeled” components, such that the predictive software is not used for predicting associated wear rates. According to the applicant, locations of “susceptible non-modeled” inspections are selected based on relative susceptibility and the considerations for these inspections are the same as for modeled piping. The staff finds this acceptable, because NSAC-202L describes susceptible non-modeled lines and the applicant is treating the gray cast iron components the same as other susceptible non-modeled components in the Flow-Accelerated Corrosion Program. The staff's concern described in RAI B.1.18-6 is resolved.

With regard to the “administrative controls” program element, the staff noted that NSAC-202L, Section 5.2, “Training and Engineering Judgment,” states, in part, that training of key personnel is essential and that personnel involved in the program be trained in flow-accelerated corrosion. In reviewing documentation provided during the onsite audit, the staff noted CNS Engineering Procedure 3.10, “Erosion/Corrosion Program,” Section 2.1, “Training and Qualification,” states, in part, that CNS personnel responsible for implementing the erosion/corrosion program will be qualified to TQD 0993 (a numbering in the procedures database), “Erosion/Corrosion Program Engineer.” Based on the staff's discussions with the applicant during the audit, CNS routinely uses non-CNS personnel to implement certain engineering aspects of the Flow-Accelerated Corrosion Program. However, the training and qualification section of the controlling procedure does not apply to non-CNS personnel.

In order to resolve this concern, the staff issued RAI B.1.18-3, by letter dated May 1, 2009, requesting that the applicant address whether training will be required for non-CNS personnel involved in implementing the Flow-Accelerated Corrosion Program, or if not, to justify how the recommendations in NSAC-202L, regarding personnel training, will be addressed. The applicant responded to RAI B.1.18-3, by letter dated June 15, 2009, stating LRA Section A.1.1.18 and

Section B.1.18 were revised to reflect the enhancement to stipulate requirements for training and qualification of non-CNS personnel involved in implementing the Flow-Accelerated Corrosion Program. The applicant documented this new enhancement in Attachment 2, Item 12 of the above response. The staff finds this acceptable because the training of personnel involved in the Flow-Accelerated Corrosion Program will be consistent with the guidelines in NSAC-202L. The staff's concern described in RAI B.1.18-3 is resolved.

Regarding additional administrative controls related to the program, the staff noted that NSAC-202L, Section 2.1, "Corporate Commitment," included ensuring that appropriate QA is applied. Based on the staff's discussion with the applicant during the audit, CNS classified the program's computer software, CHECWORKS (a software name), as Level C, "Business Important." In reviewing CNS Operations Manual, Station Computer Procedure 11.2, Revision 15, "Software Classification," the staff noted that Level B, "Licensing Basis" software applies to products that are important to compliance with regulatory commitments. The staff noted in CNS Document PDB-EC, Revision 0, "Erosion/Corrosion Program Basis Document," Section 4.1, "Ongoing Regulatory Commitments," that the response to NRC Bulletin 87-01, "Thinning of Pipe Walls in Nuclear Power Plants," implemented the CHECWORKS software. As such, it was not clear to the staff why this software was not classified as Level B, "Licensing Basis."

In order to resolve this concern, the staff issued RAI B.1.18-4, by letter dated May 1, 2009, requesting the basis for the current classification of CHECWORKS as Level C, "Business Important," software, and additionally to provide the basis for not classifying it as Level B "Licensing Basis," software. The applicant responded to RAI B1.18-4, by letter dated June 15, 2009, stating that CHECWORKS is not used to verify continued compliance with any regulatory commitment. In addition, the applicant stated that, in its response to NRC Bulletin 87-01, "Thinning of Pipe Walls in Nuclear Power Plants," the commitment to use improved predictive models was a one-time commitment, which had been completed.

The staff notes that, beyond the statements in NRC Bulletin 87-01, the applicant's statements in the LRA indicate that the FAC Program is based on NSAC-202L, which recommends detailed analyses be performed using a predictive methodology. In this case, the applicant chose CHECWORKS as the predictive methodology. Therefore, the staff considers the use of a predictive methodology, in this case CHECWORKS, to be an ongoing regulatory commitment, and not a one-time regulatory commitment.

In order to resolve this concern, the staff issued RAI B1.18-5, dated October 7, 2009, requesting information as to how the FAC Program will meet all applicable licensing basis requirements during the period of extended operation with respect to: (1) using improved predictive models, as stated in response to NRC Bulletin 87-01, (2) using procedures and administrative controls equivalent to the Nuclear Management and Resources Council (NUMARC) Program, as stated in response to NRC GL 89-08, and (3) being based on EPRI recommendations in NSAC-202L, as stated in the USAR supplement of the LRA. The applicant responded to RAI B.1.18-5 by letter dated November 4, 2009, and stated that the CNS program is essentially the same program described in NSAC-202L, which includes the use of a predictive model such as CHECWORKS, and that the NSAC program meets the NUMARC guidance, which was cited in the CNS response to GL 89-08. The applicant further stated that the software classification of CHECWORKS is unrelated to meeting the licensing basis requirements during the period of extended operation because the referenced guidance documents do not specify a particular level for software classification. In addition, the applicant stated that the use of CHECWORKS satisfies the criterion for predictive modeling in the Flow-Accelerated Corrosion Program, but CHECWORKS is not used to verify compliance with regulatory commitments. The applicant further stated that CHECWORKS is not characterized as a regulatory commitment for future action proposed in the LRA, since the establish Flow-Accelerated Corrosion Program already includes the use of CHECWORKS as the analytical tool for predictive modeling.

Although the staff agrees that the referenced guidance documents do not specify a particular level of software classification, the applicant's initial response to this issue indicated that its software classification is contingent on not having an ongoing regulatory commitment. In addition, the applicant's subsequent response, indicating that CHECWORKS is not characterized as a regulatory commitment for future action, caused the staff to question whether changes to the Flow-Accelerated Corrosion Program would be appropriately controlled as part of the applicant's CLB. In order to clarify this issue, the staff held additional discussions with the applicant on January 14 and January 20, 2010. Based on information provided as part of those conference calls, the applicant acknowledged that, through statements in LRA Section A.1.1.18, it has a commitment to follow NSAC-202L, which references the use of CHECWORKS or similar predictive software, during the period of extended operation. The staff finds this acceptable because the applicant's acknowledgement of its commitment ensures that the Flow-Accelerated Corrosion Program will clearly be part of its CLB, as defined in 10 CFR 54.3, and that the use of predictive software, integral to NSAC-202L, will be appropriately classified and controlled. The staff's concern described in RAIs B.1.18-4 and B.1.18-5 is resolved.

Exception 1. LRA Section B.1.18 discusses an exception to the "detecting of aging effects" program element with regard to using only ultrasonic examinations to detect wall thinning. For this program element, GALL AMP XI.M17 notes that ultrasonic and radiographic testing is used to detect wall thinning. The applicant's basis for this exception cited a statement in NSAC-202L that ultrasonic examinations provide more complete data for measuring the remaining wall thickness.

The staff noted that the cited statement in NSAC-202L came from Section 4.5.1, "Inspection Technique," which also stated that ultrasonic techniques, radiographic techniques, or visual examinations can be used to inspect components for flow-accelerated corrosion wear. Based on the staff's discussion with the applicant during the onsite audit, the applicant indicated that the current program does not preclude the use of radiographic techniques. However, radiography had not been used in the past to detect material loss due to flow-accelerated corrosion because of the access restrictions required by radiography during outages. The applicant indicated that visual examinations are used in some cases to detect material loss, but ultrasonic examinations are subsequently used to quantify the exact extent.

The staff finds this exception acceptable because ultrasonic examinations can more precisely quantify the remaining material thickness of the component being evaluated. In addition, although the Flow-Accelerated Corrosion Program does not currently use radiographic examinations, the staff confirmed that the controlling Engineering Procedure 3.10, "Erosion/Corrosion Program," does not preclude its use.

Enhancement 1. LRA Section B.1.18 discusses an enhancement to the "scope of program" program element with regard to updating the System Susceptibility Analysis "to reflect the lessons learned and new technology that became available after the publication of NSAC-202L, Revision 1." Based on this statement, it appeared to the staff that portions of the program may not be consistent the guidance in Revision 2 of NSAC-202L, as discussed in GALL AMP XI.M17. As noted above, in response to RAI B.1.18-1, the applicant stated that this enhancement to the program will ensure that the elements within the FAC Program implement the guidance of NSAC-202L, Revision 2. The staff finds this acceptable because the enhanced program will be consistent with the GALL Report.

Operating Experience. The staff also reviewed the OE provided in LRA Section B.1.18, conducted an independent search of the applicant's condition report database, audited a sample of condition reports related to this program, and interviewed the applicant's technical staff during the audit to confirm that plant-specific OE revealed no degradation not bounded by industry experience.

Based on the condition reports reviewed, the staff concludes that the existing program effectively identified and resolved flow-accelerated corrosion issues. In condition reports CNS-2006-08712 and CNS-2007-01210, the applicant identified leaking valves which prompted subsequent examinations of the downstream piping. The downstream piping had initially been appropriately excluded based on the valve's isolation function. In a variety of other instances, repairs or replacements were made to components after the applicant determined that adequate wall thickness could not be assured until the next RFO. The staff considered all of the above cases as appropriate incorporation of OE into the program.

In addition to site-specific OE, the staff noted condition reports which were initiated as a result of OE from other sites. Condition report CNS-2008-04265 documented the OE report for FW heater shell leakage at several utilities. The associated evaluation by the applicant described past inspections and future corrective actions. The staff considered the above activities to have adequately addressed the issue.

Additionally, during the staff's discussion with the applicant's technical staff, the program owner indicated that that he was a member of and attended periodic meetings for the CHECWORKS users group. The staff noted that NSAC-202L, Section 2.3, "Industry FAC [flow-accelerated corrosion] Experience," recommended membership in the above users group as a way to share industry experience.

Based on the above reviews and discussions during the audit regarding OE, the staff concludes that the present program appears to effectively manage flow-accelerated corrosion in high-energy carbon steel piping and components. The staff confirmed the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

USAR Supplement. In LRA Section A.1.1.18, the applicant provided the USAR supplement for the FAC Program. As discussed above, as a result of RAIs B.1.18-2 and B.1.18-3, the applicant revised this section, in Attachment 2, Item 6 and Item 7 of its letter dated June 15, 2009. The revised information stated that the enhancements to the FAC Program will be implemented prior to the period of extended operation. The applicant issued commitment NLS2008071-11 (Revision 1) in the same letter to document implementation of the associated enhancements.

Based on its review of the above information, the staff determines that the information in the USAR supplement is an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's FAC Program, including the applicant's responses to the RAIs, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and determined that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. Also, the staff reviewed the enhancement and the applicant's response to RAI B.1.18-1 and confirmed that its implementation through Commitment No. NLS2008071-11, Revision 1, prior to the period of extended operation would make the existing AMP consistent to the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP, including the applicant's responses to the RAIs, and finds that it provides an adequate summary description of the program in accordance with 10 CFR 54.21(d).

3.0.3.2.14 Inservice Inspection Program

Summary of Technical Information in the Application. In LRA Section B.1.19, the applicant described its ISI Program as an existing program that is consistent, with exceptions, to the GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD." The applicant stated that the program is encompassing the requirements of the ASME Code Section XI, Division 1, Subsections IWB, IWC, IWD, 2001 Edition through the 2003 Addenda.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The staff reviewed the exceptions to determine if the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits it. The staff also confirmed that the applicant's program contains all of the elements of the GALL Report. The staff conducted onsite interviews with the applicant to confirm these results.

In comparing the elements in the applicant's program to those in the GALL AMP XI.M1, the staff noted the program elements in the applicant's AMP claim of consistency with the GALL Report were, in fact, consistent with the GALL AMP XI.M1 with exceptions.

The staff noted the applicant had indicated that the current scope of the program applies to the ASME Code Section XI, 2001 Edition, through the 2003 Addenda. The program description in the GALL AMP XI.M1 states that the GALL Report applies to inspection, repair, and replacement activities for the ASME Code components covered in the ASME Code Section XI, 2001 Edition, through the 2003 Addenda. The staff finds that this is consistent with program description statement in GALL AMP XI.M1.

The applicant's current ISI 10-year interval commenced on March 1, 2006, and will end on February 28, 2016. However, the proposed extended period of operation will start on March 1, 2014. Therefore, there will be a two-year overlap. The applicant's stated exceptions are related to relief requests submitted and approved by the staff under 10 CFR 50.55(a)(3). Since the current CNS ISI 10-year interval extends beyond the initial 40-year license period into the period of extended operation, the approved relief remains in effect until the end of that interval, consistent with the approval, but does not automatically extend at the end of the interval. If the applicant seeks relief from specific requirements of the ASME Code Section XI for the period of extended operation, the applicant will need to re-apply for relief through 10 CFR 50.55a.

The approved relief requests for the current interval include an alternative to use a risk-informed methodology in lieu of the ASME Code Section XI, Categories B-F, B-J, and C-F-2. The applicant treated this as an exception to the GALL Report. The staff noted that the approval of the risk-informed methodology cannot be assumed for the subsequent intervals during the period of extended operation. The applicant stated that it intends to re-apply for the use of the alternative through 10 CFR 50.55a for the 10-year intervals during the period of extended operation. The applicant clarified that, if the alternative is not approved for use, inspection of Code Section XI, Categories B-F, B-J, and C-F-2 will be implemented as recommended by the GALL Report. The staff found this acceptable.

Regarding the applicant's use of the risk informed ISI program, the staff issued RAI B.1.19-1 requesting additional information in a letter dated May 1, 2009. Since using risk informed Category R-A reduced the overall number of samples as compared to using ISI Categories B-F, B-J and C-F-2, the applicant needs to explain the impact of reduced sample sizing. In a letter dated June 15, 2009, the applicant provided responses to the RAI. The applicant provided detailed sample sizes based on the current ISI program and stated that the ISI program will remain in full compliance with the requirements of 10CFR 50.55a for each additional 10-year ISI interval. Based on the information, the applicant will have adequate samples in all categories with consideration of susceptibility, risk significance, and OE, therefore, the staff found it acceptable.

Operating Experience. The staff reviewed the OE described in LRA Section B.1.19. The applicant's review includes its outage examination results in 2001 and in 2005, and a program assessment in 2005. It stated that "the ISI Program detects aging effects via visual, surface and ultrasonic inspection…," and that "the ISI programs are based on industry wide experience."

The staff reviewed the applicant's OE basis document for safety significant OE relevant to the aging management of the ASME Code Class 1, 2, and 3 components. The staff noted that the applicant only provided an overall OE summary statement in the "operating experience" program element for the ISI Program and did not provide adequate examples of plant-specific OEs that would demonstrate that the AMP is accomplishing its intended objective.

During the onsite review of this AMP, the applicant supplemented the license renewal basis document for the ISI Program with three corrective action reports and examination reports. The corrective action reports documented flaw indications that were found from UT examinations performed during an outage inspection in December, 2001. Routine ISI examinations detected indication of unusual flaws in its CS piping in the RV. Based on the results, CNS implemented monitoring and Code repair/replacement. The staff noted that the inspections of these welds were implemented under the ISI Program. Thus, the staff believes that the applicant has relevant OE for the ISI Program and has taken appropriate corrective actions of the flaw indications by performing repairs of the components.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and the guidance found in SRP-LR Section A.1.2.3.10. Therefore, the staff finds this program element acceptable.

USAR Supplement. The applicant provided the USAR supplement summary for the ISI Program in LRA Section A1.1.19. The staff reviewed this section and determines that the USAR supplement summary description for the ISI Program conforms to the staff's recommended USAR supplement SRP-LR Table 3.1-2. Based on this review, the staff finds that Section A1.1.19 provides an acceptable USAR supplement summary description of the applicant's ISI Program. The staff determines that the information in the USAR supplement is an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of the audit, the review of the applicant's ISI Program and the applicant's responses to the staff's RAI, the staff finds all program elements consistent with the GALL Report. In addition, the staff reviewed the exception and the justification and determines that the AMP, with exception, is adequate to manage the aging effects for which the LRA credits it. The staff concludes that the applicant has demonstrated that effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

3.0.3.2.15 Inservice Inspection – IWF Program

Technical Information in the Application. LRA Section B.1.20 describes the existing ISI –IWF Program as an existing program which is consistent, with an exception and enhancements, with GALL AMP XI.S3, “ASME Section XI, Subsection IWF.” The applicant stated the program includes visual inspections to detect and manage evidence of degradation which may compromise support functions or load capacity.

Staff Evaluation. During its audit and review, the staff confirmed the applicant’s claim of consistency with the GALL Report. The staff reviewed the enhancements and the exception to GALL AMP XI.S3 to determine if the AMP, with the exception and enhancements, is adequate to manage the aging effects for which the LRA credits it.

The staff reviewed the applicant’s on-site documentation supporting the applicant’s conclusion that the program elements for which it claims consistency are consistent with the elements in the GALL Report. The staff also confirmed that the plant program contains all of the elements of the referenced GALL Report and that the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated. The staff conducted onsite interviews with the applicant to confirm these results.

In comparing the program elements in the applicant’s program to those in GALL AMP XI.S3, the staff noted the program elements that the applicant claimed consistency with the GALL Report were consistent with GALL AMP XI.S3.

Exception 1. LRA Section B.1.20 states an exception to the GALL Report “detection of aging effects” program element as follows:

> NUREG-1801 recommends a VT-3 visual examination as specified in Table IWF-2500-1. Lighting and distance requirements for VT-3 visual examinations are specified in Table IWA-2210-1. The maximum direct examination distance requirement is not always followed for the VT-3 examination.

The LRA further states that the above alternative to the ASME code has been approved by the staff in accordance with the provisions of 10 CFR 50.55(a)(3) for the current inspection interval. The applicant also stated that in order to continue the alternative in subsequent intervals, approval must be obtained in accordance with 10 CFR 50.55a.

The staff reviewed this exception and noted that the applicant took the exception because its inspection program includes staff approved Relief Request RI-37, which approved the use of the ASME Code Case N-686, “Alternative Requirements for Visual Examinations, VT-1, VT-2, and VT-3.” On the basis of its review, the staff determined this exception is acceptable because: (1) the relief request was previously approved by the staff, (2) relief requests are only valid for a particular inspection interval and must be reapproved for each interval, whether a plant is in the period of extended operation or not, and (3) since the issuance of Relief Request RI-37, the staff has added ASME Code Case N-686 to the list of acceptable ASME Code, Section XI code cases in RG 1.147.

Enhancement 1. LRA Section B.1.20 states an enhancement to the ISI – IWF Program "scope of program" and "detection of aging effects" program elements as follows: "The ISI – IWF Program will be enhanced to include Class metal clad (MC) piping and component supports."

The staff reviewed the corresponding program element in GALL AMP XI.S3 as well as the applicable requirements in the ASME Code Section XI, 2001 Edition. The staff determined the applicant's enhancement is consistent with the recommendations in the "scope of program" and "detection of aging effects" program elements of GALL AMP XI.S3 because those GALL Report program elements include Class MC piping and component supports. On the basis of its review, the staff finds this enhancement acceptable because when implemented prior to the period of extended operation, the program element will be consistent with the recommendations in GALL AMP XI.S3.

Enhancement 2. LRA Section B.1.20 states an enhancement to the ISI – IWF Program, "acceptance criteria" program element as follows: "The ISI-IWF Program will be enhanced to clarify that the successive inspection requirements of IWF-2420 and the additional examination requirements of IWF-2430 are applied."

The staff reviewed the corresponding program element in GALL AMP XI.S3 as well as the applicable requirements in the ASME Code Section XI, 2001 Edition. The staff determined the applicant's enhancement is consistent with the recommendations in the "acceptance criteria" program element of GALL AMP XI.S3, because the GALL Report program element references IWF-2420 and IWF-2430 in the discussion. During the audit, the staff asked the applicant why the requirements of IWF-2420 and IWF-2430 were not being applied currently. The applicant explained that all current IWF requirements were being followed and that the enhancement was intended to clarify IWF requirements within the program procedures prior to the period of extended operation. On the basis of its review, the staff finds this enhancement acceptable because when implemented prior to the period of extended operation, the program element will be in accordance with GALL AMP XI.S3.

Operating Experience. The staff reviewed the OE described in LRA Section B.1.20. In addition, the staff reviewed a sample of condition reports and interviewed the applicant's technical staff to confirm that the plant-specific OE did not reveal any degradation not bounded by industry experience. In the LRA, the applicant described several cases of degradation discovered during visual inspections over the last 10 years. The degradation included items such as a missing jam nut, stiffener plates not shown on support drawings, and a missing scale on a variable spring hanger. The staff reviewed documentation which showed the degradation was evaluated and approved for service or repaired as necessary. The staff also verified that this degradation led to successive inspections and additional examinations in accordance with IWF-2420 and IWF-2430.

During the audit, the staff identified an issue with reoccurring failures of main steam (MS) line supports at CNS dating to the 1980's. The applicant provided a CR which documented the issue and proposed an initial due date of June, 2011, to permanently resolve the issue. Although this addresses the current operating issue of the support failures it does not address the possible aging effects on the pipe due to the time spent in an unanalyzed loading condition after each support failure. By letter dated July 29, 2009, the staff issued RAI B.1.20-1 requesting that the applicant explain how the corrective action process will address the potential aging effects (i.e. structural fatigue) on the piping system due to the unanalyzed loading condition associated with the past pipe support failures.

In its response dated September 24, 2009, the applicant stated that recurring failures of CNS MS line pipe supports and the potential effect on the piping system have been identified and addressed through the Corrective Action Program (CAP). The CAP Apparent Cause Evaluation indicated MS pipe support deficiencies are the result of high-cycle fatigue loadings due to normal flow and thermal dynamic operating conditions of the system. A detailed vendor-assisted engineering study of the 24-inch diameter MS system in the heater bay is necessary to determine modifications to the piping system which may help to eliminate the recurring pipe support deficiencies. The applicant states that plans are in place at CNS, and are being tracked under CAP, to modify the 24-inch diameter MS system piping in the heater bay, in accordance with recommendations by a vendor, which should eliminate the recurring pipe support deficiencies resulting from high-cycle fatigue loadings, and reduce system vibration levels due to normal operating conditions. As part of ongoing corrective actions, the MS pipe supports are visually examined for discrepancies at the end of each operating cycle.

By letter dated March 25, 2010, the applicant provided Commitment No. NLS2010019-01 to implement the plant modifications discussed above in order to correct the main steam line support discrepancies. The staff reviewed the CNS responses to RAI B.1.20-1 and found that the applicant has appropriate plans in place (i.e., the engineering study to address fatigue loading) to address aging effects in the piping system and to eliminate the recurring pipe support deficiencies prior to the period of extended operation.

On the basis of its review, as discussed above, 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.

USAR Supplement. In LRA Section A.1.1.20, the applicant provided the USAR supplement for the ISI – IWF Program. The applicant also committed to implementing the enhancements prior to the period of extended operation (Commitment No. NLS2009071-12). The staff reviewed this section and determined that the information in the USAR supplement conforms to the supplement provided in SRP-LR Table 3.5-2 for similar programs. Therefore the staff determined the supplement is an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant’s ISI – IWF Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and determined that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. Also, the staff reviewed the enhancements and confirmed that their implementation through Commitment 12 prior to the period of extended operation would make the existing AMP consistent with GALL AMP XI.S3. 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, in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

3.0.3.2.16 Masonry Wall Program

Summary of Technical Information in the Application. LRA Section B.1.21 describes the existing Masonry Wall Program as consistent, with enhancements, with GALL AMP XI.S5, “Masonry Wall Program.” This program will manage aging effects so that the evaluation basis established for each masonry wall within the scope of license renewal remains valid through the period of extended operations.

The applicant stated that the program includes all masonry walls identified as performing intended functions in accordance with 10 CFR 54.4. Included components are the 10 CFR 50.48 required masonry walls, radiation shielding masonry walls, and masonry walls with the potential to affect safety-related components. The applicant also stated that structural steel components of masonry walls are managed by the Structures Monitoring Program. The applicant further stated that the masonry walls are visually examined at a frequency selected to ensure there is no loss of intended function between inspections.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The staff reviewed the enhancement to determine if the AMP, with the enhancement, is adequate to manage the aging effects for which it is credited in the LRA.

The staff interviewed the applicant's technical staff and reviewed the associated bases documents for the Masonry Wall Program, which provides an assessment of the AMP elements' consistency with GALL AMP XI.S5.

In comparing the program elements in the applicant's program to those in GALL AMP XI.S5, the staff noted the program elements in the applicant's claim of consistency with the GALL Report were consistent with GALL AMP XI.S5 with the exception of program element 4, "detection of aging effects." The staff determined a need for additional clarification which resulted in the issuance of an RAI. Specifically, the staff noticed that the CNS's program basis document does not discuss the inspection frequency for unreinforced masonry walls as recommended in the, "detection of aging effects" program element in the GALL Report. In addition, the program basis document does not include a technical basis for a 5-year inspection frequency. Therefore by letter dated May 1, 2009 the staff issued RAI B.1.21-1 for unreinforced masonry walls to be consistent with the GALL Report recommendations, and RAI B.1.21-2 requesting that the applicant provide technical basis for a 5-year inspection frequency. By letter dated June 15, 2009, the applicant stated that CNS does not have any unreinforced masonry walls within the scope of license renewal, and the inspection frequency of at least once every five years is based on the guidance provided in NUMARC 93-01, "Industry Guidelines for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." The staff reviewed the applicant responses and found it acceptable because: (1) there are no unreinforced masonry walls within the scope of license renewal, and (2) the inspection interval at least once every five years is also in within the guidance of American Concrete Institute (ACI) 349-3R "Evaluation of Existing Nuclear safety-Related Concrete Structures" Table 6.1 – Frequency of Inspection. Therefore, the staff's concerns described in RAI B.1.21-1 and B.1.21-2 are resolved.

The staff also noted that the Masonry Wall Program includes the guidance and lessons learned from Office of Inspection and Enforcement Bulletin 80-11 (Masonry Wall Design, U.S. Nuclear Regulatory Commission, May 8, 1980) and IN 87-67 (Lesson Learned from Regional Inspections of Licensee Actions in Response to IE Bulletin 80-11, U.S. Nuclear Regulatory Commission, December 31, 1987). The staff further noticed that the program consists of visual inspection for cracking in joints, deterioration of penetrations, missing or broken blocks, and missing mortar. However, the aging and effectiveness of steel supports associated with the masonry walls will be managed by the Structures Monitoring Program. Based on its review, the staff found the applicant's Masonry Wall Program, with the enhancement (Commitment No. NLS2008071-13) described below, consistent with the program elements of GALL AMP XI.S5, "Masonry Wall Program," and therefore acceptable.

Enhancement 1. LRA Section B.1.21 states an enhancement to the “scope of program” program element in that the 161-kV control house switchyard is included in the program.

The staff reviewed the applicant’s Masonry Wall Program, and its AERM under the program element, “scope of program” of the Masonry Wall Program. The staff found this enhancement acceptable because when the enhancement is implemented, the Masonry Wall Program will be consistent with GALL AMP XI.S5 and provide additional assurance that the effects of aging will be adequately managed.

Enhancement 2. LRA Section B.1.21 states an enhancement to the “corrective actions” program element to clarify that structures with conditions classified as “acceptable with deficiencies” or “unacceptable” shall be entered into the corrective action program.

The staff reviewed the applicant’s Masonry Wall Program, and its AERM under the “corrective actions” program element of the Masonry Wall Program. The staff found this enhancement acceptable because when the enhancement is implemented, the Masonry Wall Program will be consistent with GALL AMP XI.S5 and will provide additional assurance that the effects of aging will be adequately managed.

Operating Experience. The staff reviewed the OE provided in LRA Section B.1.21, and “Operation Experience Review Report (Masonry Wall’s section)”, and interviewed the applicant’s technical staff to confirm that the plant-specific OE has been reviewed by the applicant and was appropriately evaluated. During its audit, and walkdown, the staff found some minor indications that did not affect the structural integrity of any of the structures reviewed. Furthermore, the staff confirmed that the applicant had addressed the “operating experience” program element identified after the issuance of the GALL Report. The staff finds that the applicant’s Masonry Wall Program, with the corrective actions and enhancements discussed in the LRA, has been effective in identifying, monitoring, and correcting the aging effects of masonry walls. The staff also confirmed that plant-specific OE did not reveal any degradation not bounded by industry experience.

The staff confirmed that the “operating experience” program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

USAR Supplement. In LRA Section A.1.1.21, “Masonry Wall Program,” the applicant provided the USAR supplement for the Masonry Wall Program. The staff reviewed the regulatory commitments listed in Attachment 3 of a letter from the applicant to the NRC dated September 24, 2008, and verified that the enhancements laid out in Section A1.1.21 had indeed been included as commitment No. 13 (NLS2008071-13). The staff reviewed this section and determines that the information in the USAR supplement is an adequate summary description of the program in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant’s Masonry Wall Program, including the applicant’s response to the RAI, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancement and confirmed that its implementation through Commitment No. NLS2008071-13 prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant 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 in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program in accordance with 10 CFR 54.21(d).

3.0.3.2.17 Metal-Enclosed Bus Inspection Program

Summary of Technical Information in the Application. LRA Section B.1.22 describes the new Metal-Enclosed Bus Inspection Program as consistent, with an exception, with GALL AMP XI.E4, "Metal Enclosed Bus." The applicant stated that the Metal-Enclosed Bus Inspection is applicable to the following non-segregated metal-enclosed buses:

- non-segregated bus duct between emergency station service transformer (ESST) and 4.16-kV switchgear buses (1F and 1G)
- non-segregated bus between the start-up station service transformer X winding and 4.16-kV switchgear buses (1A and 1B)

The applicant also stated that inspections will include bus and bus connections, the bus enclosure assemblies, and the bus insulation and insulators. In addition, the applicant further stated that a sample of accessible bolted connections will be inspected for loose connections; the enclosure assemblies will be inspected for loss of material and elastomer degradation; and bus insulation or insulators will be inspected for degradation leading to reduced insulation resistance. Finally, the applicant stated that these inspections will include visual inspections as well as quantitative measurements, such as thermography or connection resistance measurements as required, and the program will be implemented prior to the period of extended operation.

Staff Evaluation. During its audit and review, the staff confirmed the applicants claim of consistency with GALL AMP XI.E4 for program elements "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "operating experience." The staff verified that the program elements claimed to be consistent by the applicant in LRA Section B.1.22 are consistent with the applicable GALL AMP XI.E4 program elements. The staff confirmed that the boundary conditions of the plant program are consistent with the boundary conditions described in GALL AMP XI.E4 except for the areas that the applicant took exception to GALL AMP X1.E4. The staff reviewed the exception to determine whether the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it.

Exception. LRA Section B.1.22 states an exception to the "parameters monitored or inspected," and "detection of aging effects" program elements by including external inspection of metal-enclosed bus into these program elements. The exception replaces the external inspection of the metal-enclosed bus enclosure assemblies normally performed under GALL AMP XI.S6, "Structures Monitoring Program" with an external inspection performed under GALL AMP XI.E4. The exception specifies the inspection of the external metal-enclosed bus enclosure assemblies in addition to the internal metal-enclosed bus inspections already performed under GALL AMP XI.E4. In LRA Section B.1.22 the applicant stated that the bus enclosure assemblies will be inspected for loss of material and elastomer degradation. In addition, the applicant states that the "parameters monitored" and "detection of aging effects" program elements are also revised to include external inspection of loss of material and elastomer degradation.

The GALL Report under Items VI.A12 and VI.A13 recommends the program described in GALL Report Section XI.S6, "Structures Monitoring Program," for managing the aging effects of hardening and loss of strength due to elastomer degradation and the loss of material due to general corrosion for the external portions of metal-enclosed bus enclosure assemblies.

The staff reviewed this exception to the GALL Report and noted that, except for specifying external inspection of loss of material and elastomer degradation, the Metal-Enclosed Bus Inspection Program elements have not been reconciled with the program elements of GALL AMP XI.S6. In RAI B.1.22-1 dated May 1, 2009, the staff requested that the applicant provide justification for the differences between GALL AMP XI.S6 program elements and the Metal-Enclosed Bus Inspection Program. In its response dated June 15, 2009, the applicant provided a program element comparison of the Metal-Enclosed Bus Inspection Program to GALL AMP XI.S6. As a result of this comparison, the applicant proposed changes to the exception stated in LRA Section B.1.22. The changes reconcile the Metal-Enclosed Bus Inspection Program elements with GALL AMP XI.S6 to incorporate external surface and elastomer inspections into the applicant's metal enclosed bus inspection program. Based on its review, the staff finds the applicant's response acceptable and the program exception acceptable because the applicant revised LRA Section B.1.22 so that LRA Section B.1.22 is now consistent with GALL AMP XI.E4 and XI.S6 program elements. The staff's concern described in RAI B.1.22-1 is resolved.

Based on its review of the exception and resolution of the RAI as described above, the staff finds the Metal-Enclosed Bus Inspection Program consistent with the program elements of GALL AMP XI.E4, with an acceptable exception, and therefore acceptable

Operating Experience. The staff reviewed the OE described in LRA Section B.1.22. The applicant stated that the metal-enclosed bus inspection program is a new program and that industry OE will be considered when implementing the program. The applicant also stated that plant-specific OE will be gained as the program is implemented during the period of extended operation, and will be factored into the program via the CNS 10 CFR 50 Appendix B QA program.

During the audit, the staff reviewed OE reports, including a sample of condition reports, preventive maintenance procedures, and interviewed the applicant's technical staff to confirm that the plant-specific OE did not reveal any degradation not bounded by industry experience.

During the audit, a walkdown was performed of the in-scope non-segregated metal-enclosed bus duct between the ESST and 4.16-kV switchgear buses 1F and 1G, and between the start-up station service transformer and 4.16-kV switchgear buses 1A and 1B. The staff noted a potential for degraded environmental conditions due to numerous birds around and on the bus enclosures and associated support structures. The applicant stated that a condition report had been previously generated to address the degraded environment but had not been dispositioned. In RAI B.1.22-2 dated May 1, 2009, the staff requested the applicant document the condition report resolution. In its response dated June 15, 2009, the applicant stated:

> The referenced condition report document was an event-driven condition not associated with the effects of aging. This condition report was dispositioned in May 2009, with the assignment of an action to eliminate the bird population that is causing the issue in the main transformer yard. Once the birds are removed, the bus ducts will be cleaned.
>
> The effects of the recent bird infestation will not result in a long-term change to the bus duct external environment that could cause degradation rendering the proposed AMP ineffective. Note, the potentially degraded environment caused by

> the bird excrement could provide a corrosive environment for aluminum, steel, and steel alloy. However, because the aging effect from this environment is loss of material, which is addressed for the period of extended operation by visual inspections performed in accordance with the metal-enclosed duct program; therefore, this operating experience would not impact the ability of the metal-enclosed bus program to provide reasonable assurance that the intended functions would be maintained during the period of extended operation.

Based on its review, the staff finds the applicant's response acceptable because the applicant dispositioned the condition report and evaluated the potential long term impact on the metal-enclosed bus environment and the ability of the Metal-Enclosed Bus Inspection Program elements to manage this environment should it occur. The applicant's response provides reasonable assurance that the intended functions will be maintained during the period of extended operation. The staff's concern described in RAI B.1.22-2 is resolved.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

<u>USAR Supplement</u>. In LRA Appendix A, Section A.1.1.22, the applicant provided the USAR supplement for the Metal-Enclosed Bus Inspection Program. The staff reviewed the USAR supplement and determined that the information provided in the USAR supplement is not consistent with SRP-LR Table 3.6-2, "[Final Safety Analysis Report] FSAR Supplement for Aging Management of Electrical and Instrumentation and Control System" because the summary description of the program does not reference the period of inspection for either a quantitative test or qualitative visual inspection.

The "detection of aging effects" program element in GALL AMP XI.E4 states that the program will be completed before the period of extended operation and every 10 years thereafter provided that visual inspection is not used to check bolted connections. GALL AMP XI.E4 further states that when a visual inspection is used to inspect bolted connections covered by insulating material, the first inspection will be completed before the period of extended operation and every five years thereafter. The sample USAR supplement description in SRP-LR Table 3.6-2 also includes testing or visual inspection frequency guidelines as referenced by GALL AMP XI.E4.

In RAI B.1.22-3 dated June 29, 2009, the staff requested that the applicant provide a justification for omitting the inspection frequencies from the LRA Section B.1.22 USAR supplement summary description. In its response dated July 29, 2009, the applicant stated that LRA Section A.1.1.22 states that the Metal Enclosed Bus Program will be implemented consistent with NUREG-1801, Section XI.E4 which specifies the applicable test and inspection frequencies. The applicant also stated that LRA B.1.22 includes an exception to add inspections for the metal enclosure assemblies. The applicant stated that LRA Section A.1.1.22 is therefore revised to state the frequency for this addition to the Metal Enclosed Bus Program. Based on its review, the staff finds the applicant's response acceptable concerning the program exception because the applicant revised LRA Section A.1.1.22 to include the frequency of inspection for the metal enclosed bus enclosure assemblies. However, the applicant referenced GALL AMP XI.E4 as providing the bolted connection and metal-enclosed bus internal inspection and test frequencies and therefore, the applicant did not include in LRA Section A.1.1.22 the GALL AMP XI.E4 inspection and test frequencies consistent with SRP-LR Table 3.6.2. The staff's concern was identified to the applicant via conference calls on September 21 and October 5, 2009. By letter dated November 30, 2009, the applicant acknowledged the staff's concern and revised

LRA Section A.1.1.22 to provide the inspection and test frequencies consistent with GALL AMP XI.E4 and SRP-LR Table 3.6.2. Based on this, the staff's concern described in RAI B.1.22-3 with respect to LRA Section A.1.1.22 is resolved.

The staff determined that the information in the USAR supplement, as clarified by the applicant's response to the RAI, is an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

The applicant committed to implement this AMP prior to the period of extended operation and identified it as LRA Commitment No. NLS2008071-14.

Conclusion. On the basis of its audit and review of the applicant's Metal-Enclosed Bus Inspection Program, including the applicant's responses to RAIs B1.22-1, 2, and 3, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and determined that the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. The staff concludes that the applicant 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, in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

3.0.3.2.18 Oil Analysis Program

Summary of Technical Information in the Application. LRA Section B.1.28 describes the existing Oil Analysis Program as being consistent, with enhancements, to GALL AMP XI.M39, "Lubricating Oil Analysis."

The applicant stated that this program maintains oil systems so that they are free of contaminants, mainly water and particulates, thus preserving an environment that is not conducive to loss of material, cracking or fouling. The applicant further stated that sampling frequencies are dependent on vendor recommendations, accessibility during plant operations, equipment importance to plant operation and previous test results. In addition, the applicant stated that the One-Time Inspection Program will confirm the effectiveness of the Oil Analysis Program.

Staff Evaluation. During its audit and review, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff reviewed the enhancements to determine if the AMP, with the enhancements is adequate to manage the aging effects for which the LRA credits it.

In comparing the elements in the applicant's program to those in GALL AMP XI.M39, the staff determined that those program elements, for which the applicant claimed consistency with the GALL Report, are consistent.

Enhancements 1 and 2. LRA Section B.1.28 states two enhancements to the "parameters monitored or inspected" program element in that the Oil Analysis Program will be enhanced to: (1) include viscosity, neutralization number, and flash point determination of oil samples from components that do not have regular oil changes, along with analytical ferrography and elemental analysis for the identification of wear particles; and (2) include screening for particulate and water content for oil replaced periodically.

The staff reviewed the corresponding program element in GALL AMP XI.M39 and noted that the GALL Report recommends that for those components that are not subject to routine oil changes, viscosity, neutralization number, and flash point testing are also determined to ensure that the lubricating oil is suitable for continued use. The GALL Report further recommends that analytical ferrography and elemental analysis be used to identify wear particles in the lubricating oil. Furthermore, for lubricating oil that is periodically replaced, the GALL Report recommends a particle count and check for water to detect abnormal wear rates, contamination by moisture, or excessive corrosion. The staff determined that the applicant's enhancements (Commitment No. NLS2009071-19) are consistent with the recommendations in the program element, "parameters monitored or inspected," of GALL AMP XI.M39. On the basis of its review, the staff finds these enhancements acceptable because when implemented prior to the period of extended operation, they will be consistent with the recommendations in GALL AMP XI.M39.

Enhancement 3. LRA Section B.1.28 states an enhancement to the "acceptance criteria" program element in that the Oil Analysis Program will be enhanced to formalize preliminary oil screening for water and particulates and laboratory analyses, including defined acceptance criteria for all components included in the scope of the program. The program will specify corrective actions in the event acceptance criteria are not met.

The staff reviewed the corresponding program element in GALL AMP XI.M39 and noted that the GALL Report recommends particle concentration will be determined in accordance with industry standards such as SAE749D, ISO 4406, ISO 112218, and NAS 1638. Furthermore the GALL Report recommends that water, particle concentration, viscosity bands, and metal limits are based on manufacturer's recommendations, industry standards, or other justified bases. During its audit the staff noted that the acceptance criteria will be based on manufacturer's recommendations or industry standards for each specific component type. Also during the audit the staff noted that this enhancement will revise the applicant's procedures to incorporate the recommendations of the GALL Report, such as preliminary screening for water/particulates and laboratory testing and defined acceptance criteria. On the basis of its review, the staff finds this enhancement (Commitment No. NLS2009071-19) acceptable because, when implemented prior to the period of extended operation, it will be consistent with the recommendations in GALL AMP XI.M39.

Operating Experience. The staff reviewed the OE provided in LRA Section B.1.28 and also interviewed the applicant's technical staff to confirm that the plant-specific and industry OE did not reveal any aging effects not bounded by the GALL Report. The staff confirmed that applicable aging effects and industry and plant-specific OE have been reviewed by the applicant and are evaluated in the GALL Report. The staff also confirmed that the applicant has addressed OE identified after the issuance of the GALL Report.

The staff noted that in 2004 an EPRI Predictive Maintenance Program Assessment was performed on the Oil Analysis Program. The applicant stated that procedures were revised to include expectations for trending, initiation of condition reports for anomalies, and periodic report generation. The staff noted that other than revisions to procedures, CNS also installed sample ports on equipment, set up a minilab on site to expedite results, better defined the responsibilities of program owners, and provided improved training. The staff determined that the applicant has taken steps to improve its Oil Analysis program based on program deficiencies identified in an EPRI Predictive Maintenance Program Assessment and these improvements allow the applicant to manage the effects of aging and initiate corrective actions prior to the loss of intended function. The Oil Analysis Program provided a mean to demonstrate the ability to manage aging and initiate corrective actions as described below.

The applicant stated that CNS quarterly oil reports provide a periodic summary from the results of oil analysis. The applicant further stated results of these analyses from the period of 2006 to 2007 indicated that lube oil from RCIC, HPCI and DG systems were within the specifications for this period. The staff noted that based on these oil analysis results for: the RCIC particulate count; the HPCI water content and the DG particulate and lead content, the applicant indicated that there was an adverse trend; however, it did not exceed the minimum acceptance limits. During its audit the staff reviewed the applicant's quarterly oil analysis reports from 2004, 2005, 2006 and 2007. The staff confirmed during its audit of the oil analysis reports that the indications, for the most part, were satisfactory oil sample results. The staff further noted that in those instances in which the applicant noted increases in particulate or water content, the applicant took appropriate actions to have the samples trended. The staff noted that the applicant took appropriate corrective actions to trend the results of oil samples that indicated excess water or particulates prior to exceeding the acceptance criteria.

The applicant stated in 2007, the service water outboard bearing oil samples appeared to be dark and contain debris. Subsequent oil analysis performed by the applicant indicated that iron and copper content had risen. The staff noted that based upon this discovery the frequency of analysis was increased from 6 months to monthly in order to improve the trending of copper and iron content. During its audit the staff noted that in March 2007, the applicant replaced the oil slinger ring (component made of copper) on the out board side and subsequently sampled the oil. The applicant weighed the oil slinger ring that was removed and noted that there was a decrease in mass compared to the new oil slinger ring. The staff noted that the results of the oil analysis were satisfactory based on the acceptance criteria. In September 2007, the applicant took corrective actions to replace the service water booster pump A. The staff noted that an oil analysis done after the pump was replaced in January 2008 indicated that there was a spike in iron content. The applicant evaluated this spike in iron content and determined that this is normal for a new pump. The staff finally noted that from July 2008 until February 2009, the iron and copper content has been relatively level. The staff noted that the applicant took appropriate corrective actions to trend oil analysis results and then replaced the oil slinger ring, which was the cause of the excess copper content, and replaced the service water booster pump A. Hence, the staff confirmed the effectiveness of the aging management program, relative to the operating experience program element.

USAR Supplement. LRA Section A.1.1.28 provides the applicant's USAR supplement for the Oil Analysis Program. The staff confirmed that the applicant's USAR supplement summary description for this program conforms to the staff's recommended USAR supplement guidance found in the SRP-LR.

In Commitment No. NL2008071-19, the applicant committed to enhancing the existing program prior to the period of extended operation by:

- including viscosity, neutralization number, and flash point determination of oil samples from components that do not have regular oil changes, along with analytical ferrography and elemental analysis for the identification of wear particles
- including screening for particulate and water content for oil replaced periodically
- formalizing preliminary oil screening for water and particulates and laboratory analyses, including defined acceptance criteria for all components included in the scope of the program

The program will specify corrective actions in the event acceptance criteria are not met.

The staff finds that the information in the USAR supplement is an adequate summary description of the Oil Analysis Program in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Oil Analysis Program, the staff finds that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff also reviewed the enhancements and confirmed that with their implementation through Commitment No. NL2008071-19 prior to the period of extended operation, the existing program will be consistent with the GALL Report AMP with which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program in accordance with 10 CFR 54.21(d).

3.0.3.2.19 Reactor Head Closure Studs Program

Summary of Technical Information in the Application. LRA Section B.1.32 describes the Reactor Head Closure Studs Program as consistent, with an exception, to GALL AMP XI.M3, "Reactor Head Closure Studs." The applicant stated that this program manages the effects of aging for reactor head closure studs and stud components constructed from materials with a maximum tensile strength limited to less than 170 ksi through the implementation of plant procedures following the examination and inspection requirements of ASME Code Section XI, Subsection IWB (2001 Edition including the 2002 and 2003 Addenda) Table, IWB-2500-1, and the guidance provided in RG 1.65, "Materials and Inspection for Reactor Vessel Closure Studs." The applicant also stated that aging effects requiring management include cracking due to SCC, and loss of material due to wear, general, pitting and crevice corrosion.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The staff reviewed the exception to determine if the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. The staff reviewed the applicant's on-site documentation supporting the applicant's conclusion that the program elements are consistent with the elements in the GALL Report AMP and compared the elements in the applicant's program with the GALL AMP XI.M3 program elements. The staff also confirmed that the plant program contains all of the elements of the referenced GALL Report and that the conditions at the plant are bounded by the conditions for which the GALL Report is evaluated. The staff conducted onsite interviews with the applicant to confirm these results.

The staff confirmed by verifying the applicant's plant basis documents that the applicant's program conforms to the requirements of the ASME Code, Section XI, Subsection IWB 2001 Edition including the 2003 Addenda for the current ISI interval, pursuant to the GALL Report.

Exception 1. LRA Section B.1.32 states an exception to the "detection of aging effects," program element regarding the distance and lighting requirements for VT-2 inspections performed for leak detection during system pressure tests. Specifically, the exception stated:

> NUREG-1802 recommends the use of ASME Section XI, Subsection IWA-2000 to set distance and lighting requirements for VT-2 inspections for leak detection performed during system pressure tests. CNS uses an alternate approach.

(1) To prevent the extra scaffolding and radiation exposure needed to meet the distance and lighting requirements of IWA-2210, CNS conducts VT-2 examinations to detect evidence of leakage from pressure retaining components without a distance limitation and prescribes examinations in accordance with IWA-5000. IWA-5000 allows examination of floor areas or equipment surfaces underneath an inaccessible component for evidence of leakage.

The LRA further states that the above alternative to the ASME Code has been approved by the staff in accordance with 10 CFR 50.55(a)(3) for the current inspection interval. To continue the alternative in subsequent intervals, approval must be obtained in accordance with 10 CFR 50.55(a).

The staff reviewed this exception and noted that the applicant took the exception because its inspection program includes staff approved Relief Request RI-37, which approved the use of ASME Code Case N-686, "Alternative Requirements for Visual Examinations, VT-1, VT-2, and VT-3." (ML062000107) On the basis of its review, the staff determined that this exception is acceptable because: (1) the relief request was previously approved by the staff, (2) relief requests are only valid for a particular inspection interval and must be reapproved each interval, whether a plant is in the period of extended operation or not, and (3) since the issuance of Relief Request RI-37, the staff has added ASME Code Case N-686 to the list of acceptable ASME Code, Section XI code cases in RG 1.147.

Based on its review of the exception as described above, the staff finds the Reactor Head Closure Studs Program consistent with the program elements of GALL AMP XI.M3, with an acceptable exception, and therefore acceptable.

Operating Experience. The staff also reviewed the OE described in LRA Section B.1.32. The applicant stated that the program is effective in the management of age related degradation associated with reactor head closure studs, as well as the detection of closure bolting leakage associated with reactor head closure studs. The staff reviewed the OE reports to confirm that the plant-specific OE did not reveal any degradation not bounded by industry experience. The reports indicated that one undesirable indication was recorded on the reactor head closure studs at the CNS site in 2001 during RE20. Additionally, several non-recordable indications (indirect, inferred) were noted during the 2001 examination as well. The applicant noted that the indications were evaluated as satisfactory; however, it did not detail the basis for the satisfactory evaluation, or the disposition of the non-recordable indications in the LRA. The staff reviewed the detailed condition report, response and evaluation and found that proper corrective actions were taken to address the issue, including proper followup inspections on the components.

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.

USAR Supplement. In LRA Section A.1.1.32, the applicant provided the USAR supplement for the Reactor Head Closure Studs Program. The staff determines that the information in the USAR supplement is an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant's Reactor Head Closure Studs Program the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its associated justifications 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 effects of aging on the reactor head closure studs and nuts constructed from materials with a maximum tensile strength limited to less than 170 ksi will be adequately managed so that the intended functions of these components will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate description of the program in accordance with 10 CFR 54.21(d).

3.0.3.2.20 Structures Monitoring Program

Summary of Technical Information in the Application. LRA Section B.1.36 describes the existing Structures Monitoring Program as consistent, with enhancements, with GALL AMP XI.S6, “Structures Monitoring Program. The applicant stated that this program performs inspections in accordance with 10 CFR 50.65 (Maintenance Rule) as addressed in RG 1.160 and NUMARC 93-01. The applicant also stated that periodic inspections are used to monitor the condition of structures and structural commodities to ensure there is no loss of intended function. The applicant further stated that the protective coatings are not relied upon to manage the effects of aging for structures. Therefore, the Structures Monitoring Program does not address protecting coating monitoring and maintenance.

Staff Evaluation. During its audit and review, the staff noticed that In the GALL AMP XI.S6, “acceptance criteria” program element stated that acceptance criteria are to be commensurate with industry codes, standards and guidelines, and are to also consider industry and plant-specific OE. In CNS’s program basis document, the applicant also stated that “Industry and plant-specific operating experience was also considered.” However, the staff was unable to locate the “Industry and plant-specific operating experience” from the Administrative Procedure. In addition, the staff noticed that the CNS’s program basis document does not discuss Regulatory Position 1.5 in RG 1.160, Revision 2, for the “Monitoring and Trending” program element as stated in the GALL Report. The CNS’s basis document also does not include a technical basis for the 5-year inspection frequency. Therefore, by letter dated May 1, 2009, the staff issued: (1) RAI B.1.36-2 requesting that the applicant provides information regarding how industry and plant-specific OE has been incorporated, (2) RAI B.1.35-3 related to exclusion of RG 1.160, and (3) RAI B.1.36-4 to address technical basis for a 5-year inspection interval being included in the Structures Monitoring Program pursuant to the GALL Report recommendations.

By letter dated June 15, 2009, the applicant stated:

> (1) In compliance with the requirements of 10CFR 50.65(a)(3), the CNS Structures Monitoring Program specifically requires use of the operating experience process to ensure industry and plant-specific operating experience are reviewed and evaluated for applicability and potential effect on plant operations and programs for effectiveness of maintenance activities.
>
> (2) The Structures Monitoring Program is controlled by site procedures which follow the recommendations of RG 1.160, including Regulatory Position 1.5, for monitoring and trending structures condition.
>
> (3) The inspection frequency of at least once every five years is based on the guidance provided in NUMARC 93-01, “Industry Guidelines for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants.”

The staff reviewed the applicant responses and found them acceptable because: (1) CNS Structures Monitoring Program specifically requires use of the OE process to ensure that the industry and plant-specific OE are reviewed and evaluated, (2) the site procedures which follow the recommendations of RG 1.160, including Regulatory Position 1.5, for monitoring and trending structures condition, and (3) the inspection frequency of at least once every five years is also in within the guidance of ACI 349-3R "Evaluation of Existing Nuclear safety-Related Concrete Structures" Table 6.1 – Frequency of Inspection. Therefore, the staff's concerns described in RAI B.1.36-2, B.1.36-3, and B.1.36-4 are resolved.

During its audit, the staff audited the applicant's on-site documentation supporting the applicant's conclusion that the program elements are consistent with the elements in the GALL Report. The staff interviewed the applicant's technical staff and reviewed the documents related to the Structures Monitoring Program, including the license renewal program evaluation report in which the applicant claimed whether or not the program elements are consistent with GALL AMP XI.S6.

Enhancement 1. LRA Section B.1.36 states an enhancement to the "scope of program" program element in that the Structures Monitoring Program will be enhanced to clarify that additional structures requiring aging management and structural component for inspection includes each of the component types identified as requiring aging management.

The staff reviewed the applicant's Structures Monitoring Program and its AERM under the scope of the Structures Monitoring Program. The staff noted that the Structures Monitoring Program satisfies the monitoring requirements for plant structures that are within the scope of the NRC Maintenance Rule (10 CFR 50.65). CNS SCs that are within the scope of period of extended operation monitored by the Structures Monitoring Program include the following:

- biological shield wall
- control room ceiling support system
- crane rails and girders
- CRD shootout steel, diesel fuel tank hatch cover
- diesel fuel tank retaining wall and slab
- drywell fill slab
- drywell shell protection panels and jet deflectors
- drywell stabilizer supports
- foundations (buildings)
- guide wall, manholes and duct banks
- monorails
- new fuel storage vault
- office building (or administration building)
- oil tank bunker crushed rock fill
- pump baffle plates
- reactor building loop seal drain caps
- reactor building railroad airlock doors
- reactor building sump structure
- reactor cavity floor and walls
- reactor cavity liner
- reactor pedestal
- sacrificial shield wall (steel portion)
- sacrificial shield wall lateral supports
- service water pipe slab

- shield plugs
- spent fuel pool floor and walls
- steam tunnel
- sumps and sump liners
- transformer yard and switchyard support structures and foundations
- transmission towers (galvanized)
- wooden utility towers
- wooden utility poles and foundations
- traveling screen casing and associated framing,
- anchor bolts
- anchorage/embedments
- base plates
- battery racks, beams, columns, floor slabs and walls (below grade)
- blowout panels (including east end of steam tunnel)
- cable trays and supports
- component and piping supports
- conduits and conduit supports
- electrical and instrument panels and enclosures
- equipment pads and foundations
- exterior walls
- flood curbs
- flood, pressure and specialty doors
- flood retention materials (spare parts)
- heating, ventilation, and air conditioning duct supports
- instrument line supports
- instrument racks, frames, and tubing trays
- manways, hatches, manhole covers, and hatch covers
- missile shields
- penetration sealant (flood, radiation)
- penetration sleeves (mechanical/electrical not penetrating PC boundary)
- pipe whip restraints, seals and gaskets (doors, manways and hatches)
- stairway, handrail, platform, grating, decking, and ladders
- support pedestals
- vents and louvers

Guidance will be added to the Structures Monitoring Program to inspect inaccessible concrete areas that are submerged or below grade which may become exposed due to excavation, construction or other activities. CNS will also inspect inaccessible concrete areas when observed conditions in accessible areas exposed to the same environment indicate that significant concrete degradation is occurring.

The staff found this enhancement acceptable because when the enhancement is implemented, the Structures Monitoring Program will be consistent with GALL AMP XI.S6 and provide additional assurance that the effects of aging will be adequately managed.

Enhancement 2. LRA Section B.1.36 states an enhancement to the “detection of aging effects” program element in that the structures monitoring program will be enhanced to include:

- inspecting elastomers (seals, gaskets, and roof elastomers)

- identifying cracking and change in material properties

- performing an engineering evaluation of groundwater samples to assess aggressiveness of groundwater to concrete on a periodic basis (at least once every five years)

- obtaining samples from a well that is representative of the groundwater surrounding below-grade site structures to be monitored for sulfates, pH, and chlorides

- inspecting inaccessible concrete areas that are submerged or below grade which may become exposed due to excavation, construction or other activities

- inspecting inaccessible concrete areas when observed conditions in accessible areas exposed to the same environment indicate that significant concrete degradation is occurring

- performing visual structural examinations of wood to identify loss of material and change in material, and

- performing visual structural monitoring of the oil tank bunker crushed rock fill to identify loss of form

The staff found this enhancement acceptable because when the enhancement is implemented, the Structures Monitoring Program will be consistent with GALL AMP XI.S6 and provide assurance that the effects of aging will be adequately managed.

Enhancement 3. LRA Section B.1.36 states an enhancement to the “corrective actions” program element of the Structures Monitoring Program in that the procedure will be enhanced to clarify that structures with conditions classified as “acceptable with deficiencies” or “unacceptable” shall be entered into the corrective action program.

The staff reviewed the applicant’s Structures Monitoring Program, the enhancement above, and its AERM under the “corrective actions” program element of the Structures Monitoring Program. The staff found this enhancement acceptable because when the enhancement is implemented, the Structures Monitoring Program will be consistent with GALL AMP XI.S6 and provide assurance that the effects of aging will be adequately managed.

Operating Experience. The staff also reviewed the OE described in LRA Section B.1.36 and the applicant’s Operation Experience Review Report, and interviewed the applicant’s technical staff to confirm that the plant-specific OE has been reviewed by the applicant and is evaluated in the GALL Report. During its audit, the staff also conducted a field walkdown with the applicant’s technical staff to verify an existing condition of the torus room and found significant leaching deposits between torus support #15 and #16 on and around RHR and HPCI piping penetrations and the base of pipe support RH-H16; leaching deposits and water stains in the basement floor between torus support #7 and 8, #12 and 13, and at #11; and the nuts for several cast-in place anchors for the torus box beam assembly (main column support) have only a couple of threads engaged. As a result, the applicant initiated condition reports for the area. In addition, the staff also found some minor hair-line cracks on the walls and floors. However, all of the observations are minor and acceptable per the applicant’s inspection procedures and within the guidance of the ACI 201.1R (Guide for Making a Condition Survey of Concrete in Service) and ACI 349-3R (Evaluation of Existing Nuclear Safety-Related Concrete Structures) as recommended in the GALL Report. Therefore, by letter dated May 1, 2009, the staff issued RAI B.1.36-1 requesting that the applicant describe the aging effects included in the Structures Monitoring Program and how they are managed to ensure that there is no loss of intended function during the period of extended operation. By letter dated June 15, 2009, the applicant stated that the Structures Monitoring Program manages the aging effects for specific structures, components, or commodities through visual inspections of parameters in accordance with 10 CFR 50.65 (Maintenance Rule) as addressed in RG 1.160 and NUMARC 93-01. Continued implementation of the Structures Monitoring Program with the enhancements identified in LRA, AMP B.1.36, assures that the effects of aging are managed so that structures and commodities crediting this program can perform their intended function consistent with the CLB through the period of extended operation. The staff reviewed the applicant's responses and found them acceptable because the Structures Monitoring Program will ensure that the effects of aging are managed so that structures and commodities crediting this program can perform their intended function consistent with the CLB through the period of extended operation. Therefore, the staff's concerns described in RAI B.1.36-1 are resolved.

The staff also confirmed that the applicant has addressed OE identified after the issuance of the GALL Report. The staff finds that the applicant's Structures Monitoring Program, with the corrective actions discussed in the LRA, has been effective in identifying, monitoring, and correcting the effects of aging on structures. The existing program OE revealed no degradation that was not bounded by industry experience.

On the basis of its review of the OE and discussions with the applicant's technical staff, the staff concludes that the applicant's Structures Monitoring Program will adequately manage the aging effects that are identified in the CNS LRA 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 LRA program element acceptable.

<u>USAR Supplement</u>. In LRA Section A.1.1.36, the applicant provided the USAR supplement for the Structures Monitoring Program. The staff reviewed the regulatory commitments listed in Attachment 3 of a letter from the applicant to the NRC dated September 24, 2008, and verified that the enhancements laid out in Section A1.1.36 had indeed been included as commitment No. 25 (NLS2008071-25). The staff reviewed this section and determined that the information in the USAR supplement is an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

<u>Conclusion</u>. On the basis of its audit and review of the applicant's Structures Monitoring Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the enhancements and confirmed that their implementation through Commitment No. NLS2008071-25 prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program in accordance with 10 CFR 54.21(d).

3.0.3.2.21 Water Chemistry Control – Closed Cooling Water Program

<u>Summary of Technical Information in the Application</u>. LRA Section B.1.40 describes the existing Water Chemistry Control – Closed Cooling Water (CCW) Program as consistent, with an exception, with GALL AMP XI.M21, "Closed-Cycle Cooling Water System." The applicant stated

that this program includes preventative measures that manage loss of material, cracking, and fouling for components in CCW systems, namely the reactor equipment cooling (REC), turbine equipment cooling (TEC), and diesel generator jacket water (DGJW) systems. The applicant also stated that the program provides for monitoring and controlling CCW chemistry, using procedures and processes based on EPRI guidance. The applicant further stated that the Water Chemistry Control – CCW Program does not include performance and functional testing recommended by the GALL AMP XI.M21; instead a one-time inspection program is used to verify 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. The staff reviewed the exception to determine if the AMP, with the exception, is adequate to manage the aging effects for which the LRA credits it. The staff reviewed the applicant's LRA and accompanying documentation, including: (1) system operating and administrative procedures, and (2) guidelines for water chemistry parameters such as the allowable limits on conductivity, pH, and concentrations of selected chemical species for the TEC, REC, and DGJW systems. These limits define the chemistry warning limit (CWL) and selected Action Levels 1 and 2 conditions. In comparing these limits to the corresponding values in EPRI Report 1007820, the staff noted that they are in compliance in all cases where the applicant had specified the values. However, a number of EPRI 1007820 limit values were omitted from the applicant's program. For the TEC and REC water systems, the program neither specified Action Level 2 limits for conductivity, chloride, or sulfate levels, nor did it specify fluoride levels for Action Levels 1 and 2. For the DGJW chemistry, neither the Action Level 2 limit for nitrite concentrations nor the limits for chlorides and fluorides were specified. Consequently, by letter dated May 1, 2009, the staff issued RAI B.1.40-2 requesting that the applicant clarify the reason for these apparent inconsistencies between the applicant's program and EPRI Report 1007820.

The applicant responded by letter dated June 15, 2009, stating that the documentation provided to the staff during the on-site audit was CNS Chemical Procedure 8.3, which was the guidance in effect at the time the LRA was prepared. The applicant also confirmed that the chemistry parameters in question were, in fact, not included in this procedure, but that site chemistry procedures have since been revised to include these limits. The applicant further stated that limits on fluoride content for the REC and TEC systems are not included in the revised chemistry procedures, as the operating temperatures for these systems do not exceed 150 ºF and they are therefore exempt from the recommendations of EPRI 1007820. Based on its review, the staff finds the applicant's response to RAI B.1.40-2 acceptable, since it references updated CNS procedures that conform to EPRI 1007820. The staff's concerns described in RAI B.1.40-2 are resolved.

Based on its review, the staff finds those elements of the Water Chemistry Control – CCW Program claimed by the applicant to be consistent with the GALL Report to be acceptable.

Exception 1. LRA Section B.1.40 states an exception to the following GALL Report program elements: "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria." Specifically, the applicant's exception concerned performance and functional testing of CCW system components. The applicant stated:

> While NUREG-1801, 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 that equipment performance and functional testing be a part of a water chemistry control program. This appears appropriate, since 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 is typically a part of an engineering program, which would not be a part of water chemistry. In most cases, functional and performance testing verifies that component active functions can be accomplished. 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.

The staff reviewed this exception to the GALL Report and noted that the applicant took the exception because it considers performance testing and monitoring to be of little value in managing effects of aging on long-lived passive CCW system components. The applicant cited EPRI Reports TR-107396 and 1007820 to support its contention that such performance monitoring is typically part of an engineering program rather than a water chemistry program. The applicant further stated that the passive intended functions of pumps, heat exchangers and other components will be adequately managed by the CCW chemistry and onetime inspection programs. In its review the staff found that the applicant did not provide adequate information to show consistency of the “detection of aging effects” program element with GALL AMP XI.M21, which states: “Degradation of a component due to corrosion or SCC would result in degradation of system or component performance. The extent and schedule of inspection and testing should assure detection of corrosion or SCC before the loss of the intended function of the component.” Therefore, by letter dated May 1, 2009, the staff issued RAI B.1.40-1 requesting that the applicant indicate how and under what AMP the monitoring and functional testing of the closed water system components is to be carried out. If monitoring and functional testing is not carried out, the applicant was asked to justify why it is not considered necessary.

The applicant responded by letter dated June 15, 2009, and repeated its position that performance monitoring is typically a part of an engineering program, which would not be a part of water chemistry. The applicant also again stated that functional and performance testing verifies that component active functions can be accomplished and is of little value in detecting loss of passive functions due to such aging effects as loss of material. The applicant further stated that passive intended functions of pumps, heat exchangers, and other components will be adequately managed by the Water Chemistry Control Closed Cooling Water and One-Time Inspection programs through monitoring and control of water chemistry parameters and verification of absence of aging effects. The staff noted that the applicant experienced pitting corrosion in components of its REC system in the 1990’s as a result of closed-cycle cooling system water chemistry excursions. The staff also noted that the applicant more recently experienced closed system water chemistry excursions during the period 2003-2004, during which time the DO level in the TEC and REC systems averaged 6 ppm (saturation) for more than one year. This compares with a maximum level of 50 ppb specified in the applicant’s procedures. A similar excursion of shorter duration occurred in 2006. In view of the fact that aging-related damage has occurred in the applicants REC system in the past and subsequent significant water chemistry excursions have also occurred in both the TEC and REC systems, the staff feels that substantial measures are required to verify that further corrosion-related aging of the applicant’s closed-cycle cooling water system has not occurred. The staff noted that GALL XI.M21, program element 5 (“monitoring and trending”) states that “internal visual inspections and performance/functional tests are to be performed periodically to demonstrate system operability and confirm the effectiveness of the program.” The staff finds that the applicant’s proposed use of its One-Time Inspection Program (LRA B.1.29) does not provide adequate verification.

In a telephone conference call on November 9, 2009, the staff stated that its concern was that, since the REC system has had a history of DO excursions, the exception taken to the GALL Report concerning performance and functional testing would be acceptable only in concert with a periodic inspection regimen, versus the proposed one-time inspection AMP. In a followup telephone conference call on January 8, 2010, the staff stated that this issue was unresolved. Subsequent to this conference call, the applicant again reviewed LRA Section B.1.40 (Water Chemistry Control – Closed Cooling Water), and noted that, while an exception was taken to GALL AMP XI.M21 (Closed-Cycle Cooling Water System) for periodic performance and functional testing, no exception was taken for the periodic internal visual inspections discussed in GALL AMP XI.M21, elements 3 and 5. The applicant indicated that internal visual inspections will be performed during the period of extended operation, when closed-cycle cooling water system boundaries are opened. These inspections would be in addition to the one-time inspection program inspections to verify effectiveness of the water chemistry control program. The applicant has agreed to provide this clarification in an RAI response supplement.

By letter dated March 25, 2010, the applicant verified that no exception was being taken for the periodic internal visual inspections discussed in GALL AMP XI.M21, elements 3 and 5, and that internal visual inspections of the components in question will be performed during the period of extended operation when the CCW boundaries are opened. Based upon its review of this response, the staff finds that the applicant has satisfactorily responded to the issue raised and that RAI B.1.40-1 is resolved.

Based on its review, the staff finds that the applicant has demonstrated that its Water Chemistry Control – Closed Cooling Water Program is consistent with the program elements of GALL AMP XI.M21.

Exception 2. The staff noted that the applicant's Water Chemistry Control – CCW Program is implemented using EPRI 1007820, "Closed Cooling Water Chemistry Guideline, Revision 1," (2004) rather than the original edition of this report, EPRI TR-107396 (1997) as recommended in the GALL Report. This change potentially impacts element 2, "preventative actions" and element 6, "acceptance criteria" of the applicant's Water Chemistry Control – CCW Program, since the corresponding elements in the GALL Report both reference the limits on corrosion inhibitor concentrations specified in EPRI TR-107396. By letter dated May 1, 2009, the staff issued RAI B.1.40-4**,** requesting that the applicant justify this deviation from the GALL Report and discuss its impact on program elements 2 and 6 with reference to limits on specific corrosion inhibitor levels, monitoring frequencies, and operating parameters.

The applicant responded by letter dated August 13, 2009 (ML092400412), stating that Revision 1 of the EPRI Closed Cycle Cooling Water Chemistry guidelines (TR-1007820) provides more detail on the various water treatment methods used at nuclear power plants and includes more detailed information on control and diagnostic parameters, monitoring frequencies, operating ranges, and action levels. The applicant also stated that there is no impact on the elements for preventive actions and acceptance criteria in NUREG-1801 (GALL) Volume 2, Chapter XI.M21, including the application and control of corrosion inhibitors stipulated in these elements. The applicant further stated that the NRC staff, in its review of the LRA for the Vogtle Electric Generating Plant, had previously concluded that the use of EPRI TR-1007820 provided guidance consistent with the recommendations in GALL AMP XI.M21 and offered more detail on the various water treatment methods used at nuclear power plants, as well as control and diagnostic parameters, monitoring frequencies, operating ranges, and action levels. Based on its review, the staff finds the applicant's response to RAI B.1.40-4 to be acceptable, since GALL AMP XI.M21 ("Closed-Cycle Cooling Water System") states that the guidance in EPRI TR-107396 provides "one acceptable method to evaluate system and component performance."

The staff finds that the updated guidance provided in EPRI Report 1007820 provides an alternative and superior method to accomplish the same goals. The staff's concern described in RAI B.1.40-4 is resolved.

In its review of the Water Chemistry Control-Closed Cooling Water Program the staff confirmed that the boundary conditions of the plant program would be enveloped by the boundary conditions described in the GALL Report program.

Operating Experience. The staff also reviewed the OE described in LRA Section B.1.40 and interviewed the applicant's technical personnel during the audit to confirm that plant-specific OE did not reveal any degradation that was not bounded by industry experience. The staff also reviewed condition reports related to the Water Chemistry Control – CCW Program.

In the LRA, the applicant cited an example in 2004, of an improper water sampling procedure and the results of a self-assessment to address system corrosion control and data tracking. The applicant's LRA "operating experience" program element failed to reference an occurrence in which the DO level in the TEC and REC cooling water systems averaged 6 ppm (saturation) for more than one year starting in 2004. This compares with a maximum level of 50 ppb specified in the applicant's program and 200 ppb specified in EPRI Report 1007820 "Closed Cooling Water Chemistry Guideline, Revision 1." Another excursion of DO in the REC cooling water system not referenced in the LRA was discovered during the staff's independent review of the applicant's OE, but the magnitude and duration of this excursion were not described. In its review, the staff noted that the applicant did not describe the long-term resolution of this problem, nor did it discuss possible degradation of the TEC and REC water systems. Therefore, by letter dated May 1, 2009, the staff issued RAI B.1.40-3 requesting that the applicant describe the long-term resolution of this problem, and provide a discussion of any resulting degradation of the TEC and REC water systems. In addition, the applicant was requested to discuss OE since these occurrences.

The applicant responded by letter dated June 15, 2009, stating that new de-aeration skids were placed into service for the TEC and REC system in July 2006, but the problem persisted until late August 2006. At that time, surge tank recirculation valves on the TEC and REC systems were found to be open, thus providing a flow path by which oxygen-saturated water continuously entered the system. These valves were closed, and the DO levels subsequently returned to acceptable values. The applicant also stated that because of the low temperatures and flow rates in the system, the principal effect of the high DO levels was the deposition of an oxide layer that inhibited corrosion. The applicant further stated that system filters and strainers were inspected for signs of corrosion products and that nothing out of the ordinary was found. Subsequent periodic inspections of filters and strainers have continued to reveal acceptable levels of corrosion products. Based on its review, the staff finds the applicant's response to RAI B.1.40.3 to be acceptable, since it adequately describes how the problem was resolved, the resulting degradation of the TEC and REC water systems, and subsequent OE. The staff's concern described in RAI B.1.40-3 is resolved.

The staff confirmed that the "operating experience" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

USAR Supplement. In LRA Section A.1.1.40, the applicant provided the USAR supplement for the Water Chemistry Control – CCW Program. The staff reviewed this section and found that it complies with the guidelines of EPRI Report 1007820. It also satisfies the recommendations of Table 3.2-2 of NUREG-1800, Revision 1 ("Standard Review Plan for Review of License

Renewal Applications for Nuclear Power Plants”). The staff determines that the information in the USAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its audit and review of the applicant’s Water Chemistry – CCW Program, including the applicant’s responses to the RAIs, 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 exception 1, would not be consistent with the GALL AMP XI.M21 because it does not include non-chemistry monitoring consisting of inspection and nondestructive evaluations. The staff concludes that the applicant has not 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 in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3 AMPs That Are Not Consistent with or Not Addressed in the GALL Report

In LRA Appendix B, the applicant identified AMPs that are plant-specific programs. For AMPs not consistent with or not addressed in the GALL Report, the staff performed a complete review to determine its adequacy in monitoring and managing aging. The staff’s review of these plant-specific AMPs is documented in the following sections.

3.0.3.3.1 Neutron Absorber Monitoring Program

Summary of Technical Information in the Application. LRA Section B.1.23 describes the existing Neutron Absorber Monitoring Program as a plant-specific program. The Neutron Absorber Monitoring Program manages the loss of material of Boral neutron absorption panels in the spent fuel racks. The program relies on representative coupon samples mounted in surveillance assemblies located in the spent fuel pool to monitor performance of the absorber material without disrupting the integrity of the storage system.

Surveillance assemblies are removed from the spent fuel pool on a prescribed schedule and physical and chemical properties are measured. From this data, the stability and integrity of Boral in the storage cells are assessed.

Staff Evaluation. The staff reviewed program elements one through six of the applicant’s program against the acceptance criteria for the corresponding elements as stated in SRP-LR Section A.1.2.3. The staff’s review focused on how the Neutron Absorber Monitoring Program manages aging effects through the effective incorporation of these program elements. The staff’s evaluation of each of these elements follows.

Scope of the Program. LRA Section B.1.23 states that the scope of the program includes all Boral in the CNS spent fuel pool. The staff reviewed the applicant’s “scope of program” program element against the criteria in SRP-LR Section A.1.2.3.1, which states that the scope of the program should include the specific SCs of which the program manages the aging. The staff confirmed that the “scope of the program” program element satisfies the criterion defined in SRP-LR Section A.1.2.3.1 and; therefore, finds it acceptable.

Preventive Actions. LRA Section B.1.23 states that the program is an inspection program and no actions are taken to prevent or mitigate degradation. The staff reviewed the applicant’s “preventive actions” program element against the criteria in SRP-LR Section A.1.2.3.2, which states that for condition or performance monitoring programs, they do not rely on preventative actions and thus, this information need not be provided. The staff confirmed that the “preventative actions” program element satisfies the criterion defined by SRP-LR Section A.1.2.3.2 and; therefore, the staff finds it acceptable.

Parameters Monitored or Inspected. LRA Section B.1.23 states that the program monitors changes that can lead to loss of material of Boral material.

The staff reviewed the applicant’s “parameters monitored or inspected” program element against the criteria in SRP-LR Section A.1.2.3.3, which states that the parameters to be monitored or inspected should be identified and linked to the degradation of the particular structure and component intended functions. A link should be established between the degradation of the particular structure or component intended functions and the parameter(s) being monitored.

After reviewing the “parameters monitored or inspected” program element, the staff determined that more information was needed. In an RAI dated June 29, 2009, the staff requested that the applicant provide additional details on neutron absorbing materials in the spent fuel pool, the inspection of Boral coupons, the applicable AMPs, and OE. The staff questioned the fact that CNS did not have neutron attenuation as part of the parameters monitored. Industry and plant-specific OE has indicated that there are conditions that could ultimately lead to reduction in neutron absorber capacity of Boral. In addition, the GALL Report states that the potential aging effect for Boral in the spent fuel pool is reduction of neutron absorbing capacity and loss of material.

The applicant responded to the RAI in a letter dated July 29, 2009. In its response, the applicant provided additional information on relevant industry and OE. In addition, supplemental information was provided regarding the Neutron Absorber Monitoring Program.

The applicant stated that the program relies on visual inspection of representative coupon samples mounted in surveillance assemblies located in the spent fuel pool to monitor performance of the absorber material without disrupting the integrity of the storage system. The program utilizes three types of sample coupons: (1) galvanic, consisting of 304 stainless steel bolted to a plate of aluminum that simulates the rack, sub-base, and seismic bracing materials; (2) Boral, consisting of a core clad on both sides with aluminum and seal welded on all edges; (3) Boral, consisting of a core clad on both sides with aluminum and seal welded on three sides to allow the core to be exposed to the spent fuel pool water (i.e., vented).

The applicant stated that the galvanic coupons are weighed, photographed, and disassembled. The disassembled coupons are visually examined, photographed, and reassembled. The Boral coupons are weighed, photographed, and visually inspected. Thickness measurements are taken at three points along the length of the coupon. The vented coupons receive a measurement of the Boral distance from the unsealed edge. Two control coupons from outside the spent fuel pool environment are inspected at the same time for comparison.

The applicant stated that the inspection data is collected and recorded on data sheets. The visual inspections check for signs of loss of material, swelling, and blistering. After completion of inspection, the coupons are returned to their original locations.

The applicant stated that reduction of neutron absorption capability has not been identified as an AERM for the Boral materials used in the CNS spent fuel pool storage racks, due to OE from neutron attenuation testing in 1982 and 1992 that indicated no loss of neutron absorption capability. Furthermore, the applicant stated that conditions that could potentially lead to a reduction in neutron-absorbing capacity due to degradation of material would first yield physical manifestations that would be detected through the Neutron Monitoring Program described in LRA Section B.1.23.

After reviewing the applicant's response to the RAI, the staff determined that more information was needed to accept the justification that there is an insignificant change in neutron-absorbing capacity of Boral in the spent fuel pool and that there is no need for further neutron attenuation testing. As a result, the staff and the applicant held a teleconference on September 21, 2009, to clarify the applicant's previous responses. Subsequently, the staff issued an additional RAI dated October 29, 2009. In the RAI, the staff requested that the applicant provide additional details on the frequency of surveillance inspections, results of the last evaluation for Boron-10 areal density measurements, and results from past coupon testing.

In its response dated November 30, 2009, the applicant stated that the frequency for surveillance inspections during the period of extended operation will occur every eight years and that monitoring of the water chemistry parameters will be conducted in accordance with EPRI water chemistry guidelines published in EPRI Report 1008192 (BWRVIP-130). In addition, the applicant provided a discussion on the test results of coupons that were identified with swelling. The applicant stated that the coupons that were identified with swelling did not exhibit any reduction in neutron attenuation performance and that they are not characteristic of swollen Boral panels in the spent fuel pool. After reviewing the applicant's response to the RAI, the staff and the applicant held a telephone conference call on January 8, 2010, to clarify certain aspects of the applicant's responses. During the call, the applicant also indicated that it would agree to perform neutron attenuation testing and provide an enhancement to the Neutron Absorber Monitoring Program to include neutron attenuation testing of representative sample coupons. By letter dated March 29, 2010, the applicant submitted Commitment No. NLS2010019-02 to confirm its commitment. The staff finds the performance of neutron attenuation testing acceptable because it is an adequate means to monitor neutron absorber degradation, which is an AERM.

Detection of Aging Effects. LRA Section B.1.23 states that the program monitors the condition of the absorber material without disrupting the integrity of the storage system. Visual inspections are used to determine and assess the extent of loss of material in Boral before there is a loss of intended function. The applicant further stated that the results from CNS Boral coupons, inspected in 1982 and 1992, were evaluated and it was found that the reduction of neutron-absorber capacity and change in material properties is insignificant. As a result, the applicant stated that CNS no longer evaluates Boral coupons for change of material properties. The applicant stated that this program manages loss of material of the Boral neutron absorber.

By letter dated July 29, 2009, the applicant provided supplemental information regarding the CNS Boral coupons, in response to RAIs. In the letter, the applicant reported that a total of 17 Boral coupons are mounted in a surveillance assembly inside the spent fuel pool. The assembly has four sides and is open to the spent fuel pool water, allowing the coupons to be exposed to the spent fuel pool water. In addition to the 17 Boral coupons mounted in the assembly, there are 2 control Boral coupons outside the spent fuel pool and 2 galvanic coupons inside the spent fuel pool. The coupon surveillance frequency is once every eight years, and after inspection, the coupons are returned to their original locations in the spent fuel pool.

The staff reviewed the applicant's "detection of aging effects" program element against the criteria in SRP-LR Section A.1.2.3.4, which states that detection of aging effects should occur before there is a loss of the SC intended functions. The parameters to be monitored or inspected should be appropriate to ensure that the SC intended functions will be adequately maintained for the period of extended operation under all CLB design conditions. This includes aspects such as method or technique (e.g., visual, volumetric, surface inspection), frequency, sample size, data collection, and timing of new one-time inspections to ensure timely detection of aging effects; and also to provide information that links the parameters to be monitored or inspected to the aging effects being managed.

After reviewing the “detection of aging effects” program element and the July 29, 2009 response letter, the staff determined that the applicant did not adequately satisfy the criterion defined in SRP-LR Section A.1.2.3.4. The staff finds the applicant’s program for management of loss of material of the Boral neutron absorber acceptable. However, in addition to loss of material, the GALL Report identifies reduction of neutron-absorber capacity as an additional AERM for Boral in BWR treated water. The applicant stated that CNS no longer monitors for reduction in neutron-absorber capacity as a result of OE. As a result, the staff issued additional RAIs dated October 29, 2009. In the RAIs, the staff requested that the applicant provide more information on surveillance inspections, past neutron attenuation testing, and results from past coupon testing.

By letter dated March 29, 2010, the applicant submitted Commitment No. NLS2010019-02 to confirm its commitment to provide an enhancement to the Neutron Absorber Monitoring Program to include neutron attenuation testing of representative sample coupons. The staff finds the performance of neutron attenuation testing acceptable because it is an adequate means to monitor neutron absorber degradation, which is an AERM.

Monitoring and Trending. LRA Section B.1.23 states that visual inspections determine the extent of loss of material. The applicant stated that these inspections are reported in a manner which allows trending of results.

The staff reviewed the applicant’s “monitoring and trending program” program element against the criteria in SRP-LR Section A.1.2.3.5, which states that monitoring and trending activities should be described, and they should provide predictability of the extent of degradation and thus effect timely corrective or mitigative actions. Plant-specific and/or industry-wide OE may be considered in evaluating the appropriateness of the technique and frequency.

This program element describes "how" the data collected are evaluated and may also include trending for a forward look. This includes an evaluation of the results against the acceptance criteria and a prediction regarding the rate of degradation in order to confirm that timing of the next scheduled inspection will occur before a loss of SC intended functions. Although aging indicators may be quantitative or qualitative, aging indicators should be quantified, to the extent possible, for allowing trending. The parameter or indicator trended should be described. The methodology for analyzing the inspection or test results against the acceptance criteria should be described. Trending is a comparison of the current monitoring results with previous monitoring results in order to make predictions for the future.

After reviewing the “monitoring and trending” program element, the staff determined that the applicant did not adequately satisfy the criterion defined in SRP-LR Section A.1.2.3.5. The GALL Report identifies reduction of neutron-absorber capacity as an AERM for Boral in BWR treated water. The applicant’s description of this element does not adequately describe how reduction of neutron-absorber capacity will be monitored and trended over the period of extended operation. Specifically, the applicant stated that CNS no longer monitors for reduction in neutron-absorber capacity as a result of OE. Therefore, the staff has concerns regarding the licensee’s ability to monitor and trend the rate of degradation of the neutron absorber material and its effect on the Boral's ability to perform its intended safety function. As a result, the staff issued additional RAIs dated October 29, 2009. In the RAIs, the staff requested the applicant to provide more information on surveillance inspections, past neutron attenuation testing, and results from past coupon testing.

By letter dated March 29, 2010, the applicant submitted Commitment No. NLS2010019-02 to confirm its commitment to provide an enhancement to the Neutron Absorber Monitoring Program to include neutron attenuation testing of representative sample coupons. The staff finds the performance of neutron attenuation testing acceptable because it is an adequate means to monitor neutron absorber degradation, which is an AERM.

Acceptance Criteria. LRA Section B.1.23 states control coupons are inspected concurrently with the coupons removed from the surveillance assembly. Comparison of these control coupons provides the acceptance criteria against which the need for corrective action is evaluated.

By letter dated July 29, 2009, the applicant provided supplemental information regarding the CNS Boral coupons, in response to RAIs (documented in SER Section 3.3.2.2.6). The applicant stated that the sample coupons are visually examined, photographed, weighed, and compared to two control coupons. The applicant further stated that the visual inspections check for signs of loss of material, swelling, and blistering. Corrective actions for unacceptable coupon results could include coupon evaluation by outside experts, rack inspection, and rack "blackness" testing.

After reviewing the "acceptance criteria" program element, the staff determined that the applicant did not adequately satisfy the criterion defined in SRP-LR Section A.1.2.3.6. The GALL Report identifies reduction of neutron-absorber capacity as an AERM for Boral in BWR treated water. The applicant did not provide acceptance criteria for reduction in neutron-absorber capacity for the CNS coupons in the spent fuel pool water. As a result, the staff and the applicant held a telephone conference call on January 8, 2010, to clarify its responses to RAIs and reiterate the staff's position on the performance of neutron attenuation testing. As a result of the call, the applicant committed to performing neutron attenuation testing as a mean to monitor for neutron absorber degradation. Additionally, the applicant agreed to provide the acceptance criteria for the neutron attenuation test. By letter dated March 29, 2010, the applicant submitted Commitment No. NLS2010019-02 to supplement the Neutron Absorber Monitoring Program to include neutron attenuation testing of representative sample coupons; acceptance criteria for reduction of neutron-absorber capacity will be based on assuring 5 percent subcriticality margin in the spent fuel pool assuming neutron absorber degradation as the only mechanism. The staff finds the acceptance criteria for neutron attenuation testing acceptable because it is an adequate means to monitor neutron absorber degradation, which is an AERM.

Operating Experience. LRA Section B.1.23 summarizes OE related to the Neutron Absorber Monitoring Program. The staff reviewed this information against the acceptance criteria in SRP-LR Section A.1.2.3.10, which states that results of an inspection of coupon samples in 2002, showed no significant degradation of Boral material. The applicant also stated that the results indicate the Boral coupon samples are not degrading within the spent fuel storage pool.

By letter dated July 29, 2009, the applicant provided supplemental information regarding OE for the CNS Boral coupons, in response to RAIs . In the letter the applicant stated that during a 1992 surveillance inspection, one Boral coupon was discovered swollen. This coupon had been in a fuel assembly storage location inside the spent fuel pool. The applicant further reported that this coupon was evaluated along with an additional non-swollen coupon and one galvanic coupon.

The applicant stated that the 1992 evaluations were as follows:

- The swollen coupon showed swelling typical of a sealed Boral sample when water leaks into the enclosed space. The bulges observed on the coupon were considered unique to the coupon and not representative of the Boral panels in the racks.
- Neutron attenuation testing and radiography showed no loss of neutron absorber material and no indication of non-uniform distribution of the boron-10 in the absorber material.
- No surface corrosion or blister formation was noted on the swollen Boral coupon.
- No significant galvanic corrosion was noted on the galvanic coupon.

The applicant concluded that the identified swelling was due to a small leak in the coupon. The applicant did not consider the coupon representative of the racks, and the Boral in the racks was considered capable of continuing to perform its function. The coupons were returned to their original locations.

Based on its review, the staff finds that: (1) OE related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on structures, systems, and components within the scope of the program, and (2) implementation of this program has resulted in the applicant taking appropriate corrective actions. Therefore, the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and the staff finds it acceptable.

USAR Supplement. LRA Section A.1.1.23 provides the USAR supplement for the Neutron Absorber Monitoring Program. The staff reviewed this USAR supplement description of the program and notes that it conforms to the recommended description for plant-specific programs as described in SRP-LR Table 3.3-2. In addition, by letter dated March 29, 2010, the applicant submitted Commitment No. NLS2010019-02 to supplement the Neutron Absorber Monitoring Program to include neutron attenuation testing of representative sample coupons.

The staff determines that the information in the USAR supplement is an adequate summary description of the program in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its technical review of the applicant's Neutron Absorber Monitoring Program, 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 in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program in accordance with 10 CFR 54.21(d).

3.0.3.3.2 Non-Environmental Qualification Bolted Cable Connections Program

Summary of Technical Information in the Application. LRA Section B.1.24, describes the Non-EQ Bolted Cable Connections Program as a new plant-specific program that will ensure that electrical cable connections will perform their intended function through the period of extended operation. The applicant stated in LRA Table 3.6.1, item 3.6.1-13, that the new plant-specific Non-EQ Bolted Connections Program will be used as an alternative to the recommended GALL AMP XI.E6, “Electrical Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.”

The applicant stated that the Bolted Cable Connections program is a sample based, one-time inspection to confirm the absence of age-related degradation of bolted cable connections that will be completed prior to the period of extended operation. The program is intended to verify the absence of age related degradation due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion and oxidation. The applicant also stated that cable connections will be sampled based on application (medium and low voltage - defined as less than 35 kV), circuit loading (high loading), and location (high temperature, high humidity, vibration, etc.) and that the technical basis for the sample selections will be documented. The applicant further stated if an unacceptable condition or situation is identified with a selected connection sample, the CNS Corrective Action Program will be used to evaluate and determine appropriate corrective action.

Staff Evaluation. The staff issued GALL AMP XI.E6 dated September of 2005, to address aging management of the metallic portion of cable connections. Subsequent to issuance of GALL AMP XI.E6, industry identified concerns with the proposed AMP. One concern was that OE did not support a conclusion that age-related degradation of cable connections is a significant concern. In reviewing the industry’s concern, the staff found that OE identified only a limited number of failed connections due to aging and that OE did not support periodic inspections as currently recommended in GALL AMP XI.E6. On September 6, 2007, the staff issued License Renewal Interim Staff Guidance (ISG) LR-ISG-2007-02, Changes to the GALL Report AMP XI.E6, “Electrical Cables Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements” for public comment (FRN 72 FR51256). LR-ISG-2007-02 proposed changes to GALL AMP XI.E6 to clarify existing guidance and recommend a sample based one-time inspection program. The staff concludes that a one-time inspection program was adequate to ensure that either aging of metallic cable connections is not occurring or the existing preventive maintenance program is effective such that a periodic inspection program is not required. The one-time inspection verifies the absence of age-related degradation of cable connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation and confirms that a periodic aging management inspection program is unnecessary during the period of extended operation. The staff is currently developing a revision to LR-ISG-2007-02 that addresses industry comments received during the ISG public comment period. The applicant acknowledged LR-ISG-2007-02 in LRA Section 2.1.3 and stated that it will implement the ISG guidance of a one-time inspection program prior to the period of extended operation for cable connections not subject to 10 CFR 50.49 EQ requirements.

The staff reviewed the Non-EQ Bolted Cable Connections Program against the AMP elements found in the GALL Report, in SRP-LR Section A.1.2.3, “Aging management Program elements,” and in SRP-LR Table A.1-1, “Elements of an Aging Management Program for License Renewal,” focusing on how the program manages aging effects through the effective incorporation of the 10 program elements. This evaluation covers 7 of the 10 program elements, 1-6 and10 (scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, and OE). The remaining AMP program elements, 7-9 (corrective actions, confirmation process, and administrative controls are part of the applicant's QA procedures discussed in Section B.0.3 of the LRA). The staff evaluation of the applicant's QA program is documented in SER Section 3.0.4.

The staff's evaluations on the above defined seven program elements follow.

Scope of Program. LRA Section B.1.24 describes the applicant's "scope of program" for this AMP.

The staff reviewed the applicant's "scope of program" program element against the criteria in SRP-LR Section A.1.2.3.1. The SRP-LR states that the program should include the specific SCs for which the program manages aging.

The applicant identified the specific commodity groups for which the program manages the aging effects as Non-EQ metallic parts of cable connections within the scope of the period of extended operation. The identified commodity groups meet the criteria of SRP-LR Appendix A.1.2.3.1. LRA Section B.1.24, "Non-EQ Bolted Cable Connections," excludes high-voltage (greater than 35 kV) switchyard connections and bolted cable connections covered under 10 CFR 50.49. The exclusion of high-voltage and 10 CFR 50.49 bolted cable connections is acceptable based on LR-ISG-2007-02 which excludes both high-voltage (greater than 35 kV) switchyard connections and 10 CFR 50.49 program connections. High-voltage switchyard connections and 10 CFR 50.49 program connections are evaluated separately in this SER under sections 3.6.22.3 and 4.4, respectively.

The applicant also excluded scope bolted connections from the program which are covered under an existing preventive maintenance program. The staff noted in its review that GALL AMP XI.E6 and LR-ISG-2007-02 do not provide for the exclusion of Non-EQ bolted connections when covered under an existing preventive maintenance program. The licensing basis for the period of extended operation may not be adequate based on this exclusion. In RAI B.1.24-1 dated May 1, 2009, the staff requested that the applicant provide further justification for the exclusion of Non-EQ bolted connections based on an existing maintenance program. In its response dated June 15, 2009, the applicant stated that in lieu of providing a detailed comparison of the preventive maintenance activities to the XI.E6 program, CNS elects to eliminate the exclusion of connections that are included in an existing preventative maintenance program. The applicant revised LRA B.1.24 Scope of Program to delete the phrase, "or an existing preventive maintenance program." Based on its review, the staff finds the applicant's response to RAI B.1.24-1 acceptable because the applicant revised the Scope of Program for LRA Section B.1.24 to eliminate the preventive maintenance program exclusion. The staff's concern described in this RAI is resolved.

With the additional information provided by the applicant in its letter dated June 15, 2009, the staff confirmed that the "scope of program" program element satisfies the criteria defined in the GALL Report and in SRP-LR Section A.1.2.3.1. The staff finds this program element acceptable.

Preventive Actions. LRA Section B.1.24 states that this one-time inspection program is a condition monitoring program; therefore, no actions will be taken as part of this program to prevent or mitigate aging degradation.

The guidance provided by SRP-LR A.1.2.3.2 states that condition or performance monitoring programs do not rely on preventive actions; therefore, this information need not be provided.

ISG LR-ISG-2007-02 and GALL AMP XI.E6 also state that no actions are taken as part of this program to prevent or mitigate aging degradation.

The staff confirmed that the "preventive actions" program element satisfies the criteria defined in ISG LR-ISG-2007-02 and in SRP-LR Section A.1.2.3.2. The staff finds this program element acceptable because the applicant's AMP is based on condition monitoring; therefore, there is no need for preventive actions.

Parameters Monitored or Inspected. LRA Section B.1.24 states this program will focus on the metallic parts of the cable connections. The applicant also stated this is a one-time inspection to verify that loosening of bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation is not an aging effect that requires a periodic AMP.

The staff reviewed the applicant's "parameters monitored or inspected" program element against the criteria in SRP-LR Section A.1.2.3.3, which states that for a condition monitoring program, the parameter monitored or inspected should detect the presence and extent of aging effects. In addition, SRP-LR Section A.1.2.3.3 also states that the parameters to be monitored or inspected should be identified and linked to the degradation of the particular SC intended functions.

The "parameters monitored or inspected" program element satisfies the SRP-LR acceptance criteria by identifying applicable aging effects (i.e., loosening of bolted cable connections) due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation aging mechanisms. The loosening of bolted cable connections aging effect and the above associated aging mechanisms agree with GALL Report Volume 1, Table 6, "Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of the GALL Report," and GALL Report Volume 2, Table VIA, "Electrical Components-Equipment Not Subject to 10 CFR.49 Environmental Qualification Requirements." Item VI.A-1 identifies the structures and/or components and aging effect and mechanism. A one-time inspection is consistent with ISG LR-ISG-2007-02 and provides assurance that the above aging mechanisms are not occurring and that a periodic inspection is not required.

The staff confirmed that the "parameters monitored or inspected" program element satisfies the criteria defined in the GALL Report and in SRP-LR Section A.1.2.3.3. The staff finds this program element is acceptable.

Detection of Aging Effects. LRA Section B.1.24 provides the applicant's description of the "detection of aging effects" program element.

The staff reviewed the applicant's "detection of aging effects" program element against the criteria in SRP-LR Section A.1.2.3.4, which states that the detection of aging effects should occur before there is a loss of the SC intended functions. The parameters to be monitored or inspected should be appropriate to ensure that the SC will be adequately maintained for the period of extended operation under all CLB design conditions. The program aspects should include the inspection or test technique (e.g., visual, volumetric, surface inspection), frequency, sample size, data collection, and timing of new one-time inspections to ensure timely detection of aging effects. SRP-LR A.1.1.3.4 also states that the program method or technique may be linked to plant-specific or industry-wide OE. Further, SRP-LR A.1.2.3.4 states that when sampling is used to inspect structures or components the basis for the inspection population and sample size should be provided.

GALL AMP XI.E6 and ISG LR-ISG-2007-02 both state that testing may include thermography, contact resistance testing, or other appropriate testing methods. ISG LR-ISG-2007-02 further clarifies that appropriate testing methods may be performed without removing the connection insulation such as heat shrink tape, sleeving, insulating boots, etc. The applicant confirms in LRA Section B.1.24 that inspection methods may include thermography, contact resistance testing, or other appropriate methods based on plant configuration and industry guidance. In the development of ISG LR-ISG-2007-02 the staff concludes that thermography or contact resistance testing is the preferred method for testing for loose cable connections. As stated above, ISG LR-ISG-2007-02 allows for other appropriate test methods that may not require the removal of heat shrink tape, sleeving, insulating boots, etc. For example, if resistance measurement cannot be performed with insulation in place and for reasons of personnel safety, energized equipment cannot be accessed to perform thermography, the staff has concluded that visual inspection is an appropriate inspection method for cable connections covered with insulating material. The visual inspection of insulated cable connections is currently permitted by GALL AMP XI.E4, “Metal Enclosed Bus” when performed on a 5-year inspection interval. Therefore, if visual inspection is used as an alternative to resistance measurement or thermography, a periodic inspection should be performed in lieu of the one-time inspection specified by LRA Section B.1.24. A periodic visual inspection is an effective means of identifying loose cable connections by inspecting for insulation discoloration, cracking, chipping, or surface contamination.

In its review, the staff found that the applicant did not provide information on the implementation or type of alternate test methods that may be applied with regard to bolted connections covered with insulating material. In RAI B.1.24-2 dated May 1, 2009, the staff requested that the applicant confirm whether or not the applicant will employ a 5-year periodic visual inspection as an “other appropriate” inspection method for insulated cable connections as part of LRA Section B.1.24, “Non-EQ Bolted Cable Connections.” In its response dated June 15, 2009 the applicant responded to the staff’s concern by stating that NPPD has no plans to employ qualitative visual inspections during the program implementation, however, should visual inspections be employed, they will be performed on a 5-year periodic basis with the first inspection prior to the period of extended operation. The applicant also clarified LRA Section B.1.24, Detection of Aging Effects, by replacing the phrase “other appropriate methods” with “other appropriate quantitative methods.” Based on its review, the staff finds the applicant’s response to RAI B.1.24-2 acceptable because the applicant clarified LRA Section B.1.24, Detection of Aging Effects, program element with respect to test methods and the use of visual inspection. The staff’s concern described in this RAI is resolved.

The applicant’s use of a representative, sample based, one-time inspection to be performed prior to the period of extended operation is consistent with ISG LR-ISG-2007-02 and is, therefore, acceptable. ISG LR-ISG-2007-02 revises GALL AMP XI.E6 to support one-time inspections. The applicant stated that the factors to be considered for sample selection will be the application (medium and low voltage), circuit loading (high loading), and location (high temperature, high humidity, vibration, etc.) and that the technical basis for the sample selected will be documented. The factors and the referenced technical basis are consistent with GALL AMP XI.E6 and ISG LR-ISG-2007-02 and are acceptable.

The staff confirmed that with RAI B.1.24-2 resolved, the “detection of aging effects” program element satisfies the criteria defined in the GALL Report and in SRP-LR Section A.1.2.3.4. The staff finds this program element acceptable.

Monitoring and Trending. LRA Section B.1.24 states that trending actions will not be included as part of this program because this is a one-time inspection.

The staff reviewed the applicant's "monitoring and trending" program element against the criteria in SRP-LR Section A.1.2.3.5, which states that monitoring and trending activities should be described, and they should provide predictability of the extent of degradation and thus effect timely corrective or mitigative actions. This program element describes how data are evaluated and may include trending. The parameter or indicator trended should be described. The methodology for analyzing the inspection or test results against acceptance criteria should also be described.

LRA Section B.1.24 states that this is a one-time inspection and the trending of inspection or test results is not included in the program due to limited data and results that are dependent on the test selected. The applicant also states that the "monitoring and trending" program element is consistent with GALL AMP XI.E6 and ISG LR-ISG-2007-02 for a one-time inspection/test program.

The staff confirmed that the "monitoring and trending" program element satisfies the criteria defined in the GALL Report, SRP-LR Section A.1.2.3.5, and the guidance given in ISG LR-ISG-2007-02. The staff finds this program element acceptable.

<u>Acceptance Criteria</u>. LRA Section B1.24 states that the acceptance criteria for each inspection or test will be defined by the specific type of inspection or test performed for the specific type of cable connections. The applicant also stated that acceptance criteria will ensure that the intended functions of the cable connections can be maintained consistent with the CLB.

The staff reviewed the applicant's "acceptance criteria" program element against the criteria in SRP-LR Section A.1.2.3.6, which states that the acceptance criteria of the program and its basis should be described. The acceptance criteria, against which the need for corrective actions will be evaluated, should ensure that the SC intended functions(s) are maintained under all CLB design conditions during the period of extended operation.

The staff noted that this program element is consistent with GALL AMP XI.E6 which does not specify specific acceptance criteria but allows that the one-time test acceptance criteria for each test, when implemented, may be defined for the specific test performed and the cable connection tested. In addition SRP-LR Section A.1.2.3.6 is also met by ensuring that the cable connection intended functions for the period of extended operation can be maintained consistent with the CLB.

The staff confirmed that the "acceptance criteria" program element satisfies the criteria defined in the GALL Report and in SRP-LR Section A.1.2.3.6. The staff finds this program element acceptable.

<u>Operating Experience</u>. The staff reviewed the "operating experience" program element described in LRA Section B.1.24. Industry OE has shown that circuits exposed to appreciable ohmic or ambient heating during operation may experience loosening of connections. The applicant stated the Non-EQ Bolted Cable Connection program is a new program that will consider industry and plant-specific OE during implementation. LRA Section B.1.24 also states that as plant-specific OE is acquired, it will be factored into the program during the period of extended operation in accordance with the CNS 10 CFR 50 Appendix B program.

The staff reviewed the OE described in LRA Section B.1.24 and the applicant's basis documents available during the plant audit. OE, including past corrective actions, can provide objective evidence to support the conclusion that the effects of aging will be managed adequately so that the SC intended functions will be maintained during the period of extended operation. In its review, the staff found that the applicant provided limited plant-specific OE with regard to Non-EQ bolted cable connections. In RAI 3.0-1 dated May 1, 2009, the staff requested an evaluation of plant-specific OE to demonstrate OE consistent with the GALL Report. In its response dated June 15, 2009, the applicant stated that during their OE review of the individual plant assessment, NPPD evaluated plant and industry OE to identify aging effects, if any, that differed from those addressed in industry guidance documents including NUREG-1801, and that no new aging effects were identified. The applicant also stated that no CNS specific OE was identified that would lead to the conclusion that the proposed AMPs will not be effective in managing the aging effects for which they are credited. The applicant further stated that with regard to future OE, an OE review program currently exists at CNS to monitor industry-wide OE and applicable items are assigned to the CNS corrective action program. Based on its review, the staff finds the applicant's response to RAI 3.0-1 acceptable because the applicant has addressed the evaluation of plant-specific OE in the development of the Non-EQ Bolted Cable Connections Program including the evaluation and applicability of future industry experience to CNS. In addition, the Non-EQ Bolted Cable Connections Program includes program elements that address corrective actions and confirmation processes to address plant-specific OE. The staff's concern described in this RAI is resolved.

To further evaluate OE, the staff also performed a supplemental search and review of the applicant's condition reports, and interviewed the applicant's technical staff confirming that the plant-specific OE did not reveal any degradation not bounded by industry experience.

The staff confirmed that the "operating experience" program element satisfies the criteria defined in the GALL Report and in SRP-LR Section A.1.2.3.10. The staff finds this program element acceptable.

USAR Supplement. In LRA Appendix A. Section A.1.1.24 the applicant provided the USAR supplement for the Non-EQ Bolted Cable Connections Program. The staff confirmed that the applicant's USAR Supplement summary description for this program is consistent with the acceptance criteria and review guidance given in SRP-LR, FSAR Supplement Sections 3.6.2.4, and 3.6.3.4, as modified by the one-time inspection program guidance of ISG LR-ISG-2007-02. The staff also concludes that the applicant's USAR supplement information is equivalent to SRP-LR Table 3.6.2, "FSAR Supplement for Aging Management of Electrical and Instrumentation and Control System," as modified by the one-time inspection program guidance of ISG LR-ISG-2007-02. Implementation of the "Non-EQ Bolted Cable Connections" program was identified by the applicant as regulatory commitment NLS2008071-15.

The staff determines that the information in the USAR supplement is an adequate summary description of the program, in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its technical review of the applicant's "Non-EQ Bolted Cable Connections" program and the applicant's responses to RAIs B.1.24-1, B.1.24-2, and RAI 3.0-1, 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 in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program in accordance with 10 CFR 54.21(d).

3.0.3.3.3 Periodic Surveillance and Preventive Maintenance Program

Summary of Technical Information in the Application. LRA Section B.1.31 describes the existing PSPM Program as a plant-specific program. As a result of RAIs for other AMPs or AMR items, the applicant revised portions of LRA Section B.1.31 in responses dated June 22, 2009, July 29, 2009, August 13, 2009, and August 17, 2009.

This program includes periodic inspections and tests that manage aging effects not managed by other AMPs, including loss of material, cracking, change in material properties, and loss of material due to wear and fouling. While primarily used for managing the effects of aging on internal surfaces, the program is also credited with managing loss of material from external surfaces for situations where the external and internal material and environment combinations are the same. The associated activities are generally implemented through repetitive tasks or through routine monitoring of plant operations. The program's representative samples will be selected from each unique material and environment combination, and will be sized to provide a 90 percent confidence that 90 percent of the population does not experience degradation (90/90). Enhancements to the PSPM Program, as documented in commitment NLS2008071-22, include adding new activities, which have been credited in the AMR for the following systems and structures:

- reactor building monorails, railroad airlock doors, reactor building crane, rails and girders and refueling bridge equipment assembly
- reactor building elastomer seals for railroad airlock doors
- SLC system accumulator shells
- HPCI system turbine lube oil heat exchanger tubes
- automatic depressurization system components (MS relief tailpipes and T-quenchers) in waterline region of the suppression chamber
- RCIC system vacuum pump discharge piping, piping elements, components and turbine lube oil heat exchanger tubes
- standby gas treatment system (SGTS) components and fan inlet flexible connections
- plant drain system drain components and pump casings
- diesel generator system exhaust gas components, intercooler tubes and fins, and SA components
- heating, ventilation, and air conditioning (HVAC) system flexible duct connections, portable fan housings, flexible trunks, and fan coil unit tubes, fins and drip pans
- PC system equipment and floor drain components
- circulating water system, nonradioactive floor drain system, heating and ventilating system, OG system, potable water (PW) system, radwaste system, diesel generator starting air (DGSA) system, and SA system piping, piping elements and components
- instrument air system PC penetration X-21

- nitrogen (N_2) system vaporizer tank and vaporizer coil

Staff Evaluation. The staff reviewed the information in LRA Section B.1.31 on the applicant's demonstration of the PSPM Program to ensure that the effects of aging, as discussed above, will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation. During the onsite audit, the staff also reviewed the applicant's program basis documents and associated reference material.

The staff reviewed the PSPM Program against the AMP elements found in the GALL Report, in SRP-LR Section A.1.2.3, "Aging management Program elements," and in SRP-LR Table A.1-1, "Elements of an Aging Management Program for License Renewal," focusing on how the program manages aging effects through the effective incorporation of the 10 program elements. This evaluation covers 7 of the 10 program elements, 1-6 and10 (scope of program, preventive actions, parameters monitored or inspected, detection of aging effects, monitoring and trending, acceptance criteria, and OE). The remaining AMP program elements, 7-9 (corrective actions, confirmation process, and administrative controls are part of the applicant's QA procedures discussed in Section B.0.3 of the LRA). The staff evaluation of the applicant's QA program is documented in SER Section 3.0.4.

The staff's evaluations on the above defined seven program elements follow.

Scope of Program. LRA Section B.1.31 states that this program, with regard to the period of extended operation includes those tasks credited with managing aging effects identified in AMRs.

The staff reviewed this program element against the criteria in SRP-LR Section A.1.2.3.1, which indicates that the specific SC should be included in the scope of the program.

The staff noted the applicant's program description includes a table listing the specific systems and structures with corresponding activities credited in the AMR. A table within the applicant's program description includes the specific components or component types which define the scope of the program. The applicant's program basis documents also contained detailed information regarding specific components within the scope of the program. Based on the staff's review, the staff finds that the applicant adequately described the scope of the program.

The staff confirmed that the "scope of program" program element satisfies the criterion in the GALL Report and the guidance in SRP-LR Section A.1.2.3.1. The staff finds this program element acceptable.

Preventive Actions. LRA Section B.1.31 states that the inspection and testing activities used to identify component aging effects do not prevent aging effects. The applicant provided no further information for this program element.

The staff reviewed this program element against the criteria in SRP-LR Section A.1.2.3.2, which indicates that preventive action information need not be provided for condition or performance monitoring programs. The staff concludes that because the applicant's PSPM program monitors the condition or performance of structures, systems, or components, preventive actions do not need to be provided.

The staff confirmed that the "preventative actions" program element satisfies the criterion in the GALL Report and the guidance in SRP-LR Section A.1.2.3.2. The staff finds this program element acceptable.

Parameters Monitored or Inspected. LRA Section B.1.31 states that the program provides instructions for monitoring structures, systems, and components to detect degradation. It also states that inspection and testing activities monitor various parameters including system flow, system pressure, surface condition, loss of material, presence of corrosion products, and signs of cracking.

The staff reviewed this program element against the criteria in SRP-LR Section A.1.2.3.3, which states that, for performance monitoring programs, a link should be established between the degradation of the particular SC intended functions and the parameter(s) being monitored or inspected.

During its onsite audit, the staff reviewed the applicant's program basis documents and noted they contained detailed information delineating specific parameters to be monitored or inspected for each of the components listed. In the majority of cases, the specified parameter was surface condition, but for several components involving elastomers, the change in material properties was the specified parameter being monitored. In another instance, the air temperature being discharged by the component was the monitored parameter. The staff concludes that appropriate parameters were specified to be monitored because the presence and extent of the correlated aging effects would be detected for each component.

The staff confirmed that the "parameters monitored or inspected" program element satisfies the criterion defined in the GALL Report and the guidance in SRP-LR Section A.1.2.3.3. The staff finds this program element acceptable.

Detection of Aging Effects. LRA Section B.1.31 states that the PSPM program provides for periodic component inspections and testing to detect aging effects. The applicant also stated that the inspection and test intervals are established so that they provide timely detection of degradation.

The staff reviewed this program element against the criteria in SRP-LRA Section A.1.2.3.4, which states that aging effects should be detected before there is a loss of the SC's intended functions. In addition, the method, frequency, sample size, and timing should be appropriate to ensure timely detection of aging effects.

With regard to frequency of inspections or tests, LRA Section B.1.31 states that the intervals are based on manufacturers' recommendations, and industry and plant-specific OE. The LRA states that each inspection or test occurs at least once every five years; however, the staff noted that the corresponding portion of the applicant's program basis document states that each inspection or test occurs at least once every 10 years. In addition, the staff noted that in a separate attachment to the program basis document, the inspection of the HPCI turbine lube oil cooler heat exchanger tubes was specified as being performed once every six years.

In order to resolve the above discrepant information, in RAI B.1.31-1 dated July 14, 2009, the staff requested that the applicant confirm that each inspection or test discussed in the PSPM Program occurs at least once every five years, instead of less frequently. In its response dated August 13, 2009, the applicant confirmed that each inspection or test would occur at least once every five years. The staff finds this acceptable because the discrepant information had been adequately clarified. The staff's concern described in RAI B.1.18-1 is resolved.

With regard to sample size, LRA Section B.1.31 indicated several instances where a representative sample will be selected for each unique material and environment combination. According to the applicant, the sample size will be determined in accordance with Chapter 4 of

EPRI Report 107514, "Age Related Degradation Inspection Method and Demonstration," which outlines a method to determine the number of inspections required for 90 percent confidence that 90 percent of the population does not experience degradation (90/90). In addition, the applicant indicated that components with the same material-environment combinations at other facilities may be included in the sample.

The staff separately noted that LRA Section B.1.29, "One-Time Inspection," also referred to the above cited EPRI document as a basis for determining the sample size. The cited EPRI document referred to an internal Calvert Cliffs Nuclear Power Plant memorandum as the basis for concluding that 90/90 was an appropriate sample size. However, the applicant did not provide any bases as to why this approach would be appropriate for CNS. In RAI B.1.29-1, dated May 15, 2009, the staff requested that the applicant justify the basis for using Chapter 4 of EPRI Report 107514. As documented in SER Section 3.0.3 (One –Time Inspection AMP), the staff finds the applicant's basis for using a sample size based on 90/90 is considered acceptable. The staff's concern regarding the basis for using 90/90 as the basis for selecting the sample size is resolved.

In addition, the staff noted that the applicant's program basis documents contained a table specifying the type of inspection or test being conducted, with the corresponding aging effect being managed, for each of the components or systems listed. Examples of the specified inspections or tests from the above mentioned table included visual or eddy current examinations for evaluating surface conditions, performance testing for fouling, and NDEs for cracking. The staff concludes that the methods specified by the applicant are appropriate, because the methods are able to detect the specified aging effects for the systems and components in this program.

Based on this review, the staff confirmed that the "detection of aging effects" program element satisfies the criterion in the GALL Report and the guidance in SRP-LR Section A.1.2.3.4. The staff finds this program element acceptable.

Monitoring and Trending. LRA Section B.1.31 states that PSPM activities provide for monitoring and trending of aging degradation, and that inspection and testing intervals are established so that they provide timely detection of degradation. The applicant also indicated that the inspection and testing intervals are dependent on component material and environment, and consider industry and plant-specific OE and manufacturers' recommendations.

The staff reviewed the applicant's "monitoring and trending" program element against the criteria in SRP-LRA Section A.1.2.3.5, which states that monitoring and trending should provide predictability of the extent of degradation and timely corrective or mitigative actions.

During its onsite audit, the staff reviewed the applicant's program basis documents and noted that the controlling procedure requires technical bases for each preventive maintenance activity to be maintained current and accurate, and that feedback be provided upon completion of each preventive maintenance order. In addition, the controlling procedure delineates feedback codes based on the as-found condition of the system, structure or component, and requires that the Preventive Maintenance Program Engineer review completed orders, trend the feedback information, and initiate preventive maintenance changes based on feedback codes and comments. The staff concludes that each activity's required technical bases will provide the bases for predictability of the extent of degradation, and that the program's feedback and trending activities will provide for timely corrective actions.

Based on this review, the staff confirmed that the "monitoring and trending" program element satisfies criterion defined in the GALL Report and the guidance in SRP-LR Section A.1.2.3.5. The staff finds this LRA program element acceptable.

Acceptance Criteria. LRA Section B.1.31 states that the associated acceptance criteria are defined in specific inspection or test procedures, and that the procedures confirm component integrity by verifying the absence of aging effects or by comparing applicable parameters to limits based on applicable intended functions established by the plant design basis.

The staff reviewed this program element against the criteria in SRP-LRA Section A.1.2.3.6, which states that acceptance criteria for determining the need for corrective actions should ensure that the SC intended functions are maintained under all CLB design conditions.

Although the applicant explicitly stated the PSPM program acceptance criteria are defined in specific inspection or test procedures, all of the new activities discussed in this section of the LRA are not yet included. In commitment NLS2008071-22, the applicant stated that program enhancements will either incorporate the listed items in an existing preventive maintenance activity or incorporate these elements in a new preventive maintenance activity, prior to the period of extended operation. As such, this effort has not been completed and the acceptance criteria are not currently defined in inspection or test procedures.

During its onsite audit, the staff noted that an attachment to the applicant's program basis document specified acceptance criteria for each parameter being monitored or inspected. However, approximately 60 percent of the parameters being monitored were given as "surface condition," and in almost every case the acceptance criterion was specified as "no unacceptable loss of material." Based on this wording, some loss of material was apparently acceptable, even though the applicant stated that procedures confirm component integrity by verifying the absence of aging effects.

The applicant did not provide the bases for determining how much material loss would be considered unacceptable. Similarly, for flexible materials, the applicant did not quantify unacceptable cracking or changes in material properties. Since the components varied widely, from the reactor building crane, accumulator shells, piping, valves, filter housings, bolting, restricting orifices, pump casings, diesel exhaust components, tanks, fan housings, etc., it was unclear to the staff how the applicant would determine what constituted an unacceptable loss of material, cracking, or changes in material properties.

In order to resolve this issue, in RAI B.1.31-2 dated July 14, 2009, the staff requested that the applicant provide the bases for the specified acceptance criteria. In its response dated August 13, 2009, the applicant stated that any indications or relevant conditions of degradation are reported and submitted for further evaluation as part of the corrective action program. In addition, these evaluations ensure the components are maintained within all CLB design conditions. The staff finds this acceptable because all indications or relevant conditions will be evaluated for CLB design conditions, which will ensure that the structure or component will continue function as originally designed. The staff concern regarding the basis for the specified acceptance criteria is resolved.

Based on this review, the staff confirmed that the "acceptance criteria" program element satisfies criterion defined in the GALL Report, and the guidance in SRP-LR Section A.1.2.3.6. The staff finds this program element to be acceptable.

Operating Experience. The staff also reviewed the OE provided in the LRA Section B.1.31. The staff confirmed that applicable aging effects and industry and plant-specific OE have been reviewed by the applicant and revealed no degradation not bounded by industry experience. In LRA Section B.1.31, the applicant provided typical results from past inspections and preventive maintenance activities which provided evidence that the PSPM program is effective for managing the effects of aging for the various components or systems. The applicant provided examples for specific components where aging effects such as loss of material or changes in material properties were identified and the components were subsequently repaired or replaced according to the site's corrective action 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.

USAR Supplement. In LRA Section A.1.1.31, the applicant provided the USAR supplement for the PSPM program. The staff reviewed this section and found it acceptable because it provided a summary description of the AMP and activities for managing the effects of aging. The staff determines that the information in the USAR supplement is an adequate summary description of the program in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its technical review of the applicant's PSPM Program and the responses to RAIs B.1.31-1 and B.1.31-2, 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 in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program in accordance with 10 CFR 54.21(d).

3.0.3.3.4 Water Chemistry Control – Auxiliary Systems

Summary of Technical Information in the Application. LRA Section B.1.38 describes the Water Chemistry Control – Auxiliary Systems as an existing program that does not have a corresponding NUREG-1801 Program. The applicant stated that the program manages loss of material and cracking for components exposed to treated water and steam. The applicant further stated that program activities include sampling and analysis of water in auxiliary condensate drain (ACD) system components, AS system components, and heating and ventilation (HV) system components to minimize component exposure to aggressive environments. Lastly, the applicant stated that the One-Time Inspection Program utilizes inspections or non-destructive evaluations of representative samples to verify that the Water Chemistry Control – Auxiliary Systems Program has been effective at managing aging effects.

Staff Evaluation. The staff reviewed the applicant's 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 the 10 program elements. The staff's evaluations on seven of these elements follow.

Scope of Program. LRA Section B.1.38 states that the program activities include sampling and analysis of water in ACD system components, AS system components, and HV system components to minimize component exposure to aggressive environments.

The staff noticed that the applicant had proposed a plant-specific water chemistry program to manage the loss of material and cracking of its auxiliary systems (e.g., AS system components, HV system, etc.) By letter dated May 1, 2009, the staff issued RAI B1.38-1 to request that the applicant explain the reasons a plant-specific water chemistry program is necessary to manage the loss of material in its auxiliary systems. By letter dated June 15, 2009, the applicant stated that, "The design of the AS system electric boiler requires a high level of water conductivity to propagate the electric arc generated by the boiler coil. This renders the system unsuitable for control under the EPRI guidelines for chemistry control of CCW referenced by the GALL Report programs. Similarly, the chemistry requirements for the chilled water portion of the HV system reflect the specific design of the components involved so that EPRI requirements cannot be met." The staff noted that, due to the nature of the electric-arching boilers, boiler water with high conductivity is needed to ensure the proper functioning of the boiler arching. Hence, the water chemistry guidelines designed for reactor water chemistry will not work for the arching boilers because of the high purity (low conductivity) water requirement for the reactor. Likewise, the addition of ethylene glycol to the HV system for freeze protection purposes necessitates that the applicant seek exemption(s) from the GALL Report's Closed-Cycle Cooling Water Program. Therefore, a plant-specific water chemistry control program is appropriate to manage the loss of material and cracking in the aforementioned auxiliary systems.

In evaluating the applicant's response that supplements LRA Section 3.3.2, the staff confirmed that the "scope of program" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.1 because the applicant has appropriately identified the SSC this program is intended to manage. Hence, the staff finds this program element acceptable.

Preventive Actions. LRA Section B.1.38 states, in part, that, the program includes monitoring and control of water in the ACD system components, AS system components, and HV system components to minimize exposure to aggressive environments, thereby mitigating the effects of aging.

The staff reviewed the applicant's "preventive actions" program element against the criteria in SRP-LR Section A.1.2.3.2, which states that the activities for prevention and mitigation should be described and that these actions should mitigate or prevent aging degradation.

By letter dated May 01, 2009, the staff issued RAI B1.38-1 requesting that the applicant explain the preventive action(s) for the auxiliary systems. By letter dated August 13, 2009, the applicant outlined the sampling activities. The staff reviewed the applicant's preventive actions and noted that they include monitoring and control of the water chemistry through sampling. For instance, the staff noted that water samples are taken weekly when the AS system is in operation. Adjustments to the water treatment chemicals are based on the results of the water samples. The staff concludes that the applicant's preventive actions are appropriate to protect the auxiliary systems against aggressive environments and mitigating aging degradation effects because the applicant's preventive actions are consistent with the general industry practice of protecting similar equipment.

The staff confirmed that the "preventive actions" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.2. The staff finds this program element acceptable.

Parameters Monitored or Inspected. LRA Section B.1.38 states, in part, that in accordance with industry recommendations, ACD systems, and AS system water parameters monitored are pH, conductivity, phosphate, sulfite, and iron. Furthermore, it also states that in accordance with industry recommendations, the HV systems parameter monitored is sodium nitrite ($NaNO_2$).

The staff reviewed the applicant's "parameters monitored or inspected" program element against the criteria in SRP-LR Section A.1.2.3.3, which states, in part, that the parameters monitored or inspected should be identified and linked to the degradation of the particular SC intended functions(s). Section A.1.2.3.3 further states that for prevention and mitigation programs, the parameters monitored should be the specific parameters being controlled to achieve prevention or mitigation of aging effects.

The LRA identified system-specific chemical parameters to be monitored based on industry recommendations. However, no specific industry recommendations were given in the LRA. By letter dated May 1. 2009, the staff issued RAI B1.38-1 requesting that the applicant provide references to the industry recommendations. By letter dated June 15, 2009, the applicant stated that the chemical parameters monitored had come from the equipment manufacturer and a water treatment company. The staff reviewed the applicant's response and verified that the parameters the applicant selected to monitor indeed would provide diagnostic information about the system performance. For instance, the staff noted that, according to general industry practice, maintaining the boiler water in the stated percent of hydrogen (pH) range (9.0 – 11.4) ensures an alkaline environment to minimize material losses due to acid attack on the metals. Likewise, sulfite is added to the boiler as an oxygen scavenger. Sufficient quantities of sulfite in the boiler water minimize the amount of the DO present in the boiler, thereby protecting the boiler from corrosion (especially pitting corrosion). An adequate amount of phosphates in the boiler water maintains the pH and controls the formation of hard scales inside the boilers, thereby ensuring adequate heat transfer across the boiler heating elements to the water (The Nalco Water Handbook, 2nd edition, p. 19.9, pp 34.16–18, and pp 39.17–18). The staff verified that the success of the boiler water treatment program can be confirmed through the iron readings because the iron readings give an indication of the amount of material lost to the heating medium. With respect to the HV system, the applicant's response stated $NaNO_2$ level is in accordance with general guidelines for CCW systems (Betz Handbook of Industrial Water Conditioning, 8th edition, p. 212). It is also within the EPRI guidelines (EPRI Closed Cycle Cooling Water Chemistry Guideline, Table 4-2, TR-107396, 1997). The staff determined the selection of the parameters, as well as the respective ranges, were appropriate.

The staff confirmed that the "parameters monitored or inspected" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.3. The staff finds this LRA program element acceptable.

Detection of Aging Effects. LRA Section B.1.38 states, in part, that the program manages loss of material and cracking for ACD system components, loss of material and cracking for AS system components, and loss of material for HV system components. The applicant further stated that the One-Time Inspection (LRA B.1.29) for water chemistry describes inspections planned to verify the effectiveness of water chemistry programs to ensure that significant degradation is not occurring and that component intended function is maintained during the period of extended operation.

The staff reviewed the applicant's "detection of aging effects" program element against the criteria in SRP-LR Section A.1.2.3.4, which states, in part, that the parameters to be monitored or inspected should be appropriate and includes aspects such as method or techniques (e.g., visual, volumetric, surface inspection), frequency, and sample size. The SRP-LR further states that this program element describes "when," "where," and "how" program data are collected.

The staff reviewed B.1.38 and noticed that it called upon the One-Time Inspection in LRA B.1.29 as a mean to verify the effectiveness of water chemistry control for the auxiliary systems. Non-destructive methods, such as visual or ultrasonic examinations, are used to inspect the equipment. Representative samples from various locations will be examined during the inspection. The staff reviewed the EPRI document and determined that the One-Time Inspection would offer detection of the equipment aging effects. When coupled with the sampling activities under the Auxiliary Systems Water Chemistry Program, the One-Time Inspection provides assurance that the auxiliary systems would be maintained to achieve their intended functions during the period of extended operation.

The staff confirmed that the “detection of aging effects” program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.4. The staff finds this LRA program element acceptable.

Monitoring and Trending. LRA Section B 1.38 states, in part, that trending is not required to predict the extent of degradation since maintaining parameters within acceptance criteria prevents degradation. The applicant further stated that OE indicates effectiveness in preventing aging effects if parameters are maintained within limits.

The staff reviewed the applicant’s “monitoring and trending” program element against the criteria in SRP-LR Section A.1.2.3.5, which states, in part, that there should be a description of the monitoring and trending activities, the parameter or indicator trended, and the methodology for analyzing the inspection or test results against the acceptance criteria.

The LRA included little information regarding the corrective actions taken when acceptance criteria were not met. Hence, by letter dated May 01, 2009, the staff issued RAI B1.38-1 requesting that the applicant provide details on the corrective actions when monitored parameters exceeded the acceptance criteria. By letter dated August 13, 2009, the applicant stated that a low $NaNO_2$ (a corrosion inhibitor) level in the chilled water system was detected twice in 2006. In both incidences, additional inhibitor was added to the system to return the nitrite concentration to within the prescribed specification. The applicant further stated that high iron levels were observed four times in one boiler and twice in the second boiler in the past five years. The blow-down from the boilers was raised to lower the iron levels. Similarly, a low sulfite (an oxygen scavenger) level was detected numerous times during the same 5-year period. In each of these incidences, additional sulfite was injected into the boilers to raise the chemical concentrations within the specification. The applicant further stated that additional steps were taken to improve staff training and internal communications. The staff reviewed the applicant’s response and verified that the applicant’s corrective actions were effective to return the monitored parameters to within the acceptance ranges.

The staff confirmed that the “monitoring and trending” program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.5. The staff finds this LRA program element acceptable.

Acceptance Criteria. LRA Section B 1.38 states, in part, that in accordance with industry recommendations, acceptance criteria for the ACD system and AS system are pH (9.0 – 11.4), conductivity (less than 2100 µmho/cm), phosphate (greater than 50 ppm), sulfite (greater than 3 ppm), and iron (less than 2 ppm). For the HV systems the acceptance criteria is $NaNO_2$ greater than 750 ppm.

The staff reviewed the applicant’s “acceptance criteria” program element against the criteria in SRP-LR Section A.1.2.3.6, which states, in part, that the acceptance criteria of the program and its basis should be described and could be specific numerical values.

The staff noticed the LRA clearly listed the numerical acceptance criteria. Based on the applicant's response to RAI B1.38.1 the staff determined the respective values selected for the monitored parameters were suitable for the auxiliary systems. For instance, the staff noted that a phosphate-based program with sulfite as an oxygen scavenger is common for industrial boilers of low to medium range pressure (Betz Handbook of Industrial Water Conditioning, 8th edition, p. 78 and 90). Similarly, maintaining adequate levels of $NaNO_2$ as corrosion inhibitor is also an acceptable way of protecting the chilled water system against corrosion (Drew Principles of Industrial Water Treatment, 11th edition, p. 190). Hence the systems are expected to achieve their intended functions during the period of extended operation if the acceptance criteria are properly met.

The staff confirmed that the "acceptance criteria" program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.6. The staff finds this LRA program element acceptable.

Operating Experience. The staff also reviewed the OE described in LRA Section B1.38. The applicant stated, in part, that from 2003 through 2008, samples were routinely (e.g., weekly) taken from the auxiliary condensate (AC) and steam system (heating boilers) and the HV system (admin chillers) for analysis. On occasions of variance, corrective action was taken to bring the variance back into compliance. The applicant also stated that in 2006, a self-assessment was performed to address chemistry monitoring, control, and evaluation. This assessment prompted training for the process for chemical labeling and permits to assure adequate implementation. The applicant further stated that the self-assessment also prompted increased attention to reviewing and documenting instrument trends and bias in accordance with procedure. This self assessment included actions and recommendations which were resolved to upgrade the program to confirm its effectiveness.

Since the applicant did not describe in detail the variances and corrective actions, the staff issued RAI B1.38-1 by letter dated May 1, 2009, requesting additional details on the nature of the variances and the associated corrective actions. By letter dated August 13, 2009, the applicant stated that low $NaNO_2$ in the chilled water system was detected twice in 2006. Additional nitrite was injected into the chilled water system to restore the chemical levels. Likewise, high iron concentrations and low sulfite levels were observed in the boilers in the past five years. Corrective actions included increasing boiler blow-down to remove excess iron and raising sulfite injection rates into the boilers. The staff reviewed the applicant's response and verified that corrective actions taken were effective in returning the monitored parameters to within the acceptable ranges. The program upgrades instituted by the applicant after the 2006 self-assessment, provided additional assurance that the auxiliary systems can be treated and maintained consistent with the industry guidelines.

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 LRA program element acceptable.

USAR Supplement. In LRA A 1.1.38, the applicant provided the USAR supplement for the Water Chemistry Control – Auxiliary Systems Program. The staff reviewed this section and found that it is consistent with the AMP activities in Section B1.38 regarding program sampling and analysis activities, as well as the One-Time Inspection Program.

The staff determines that the information in the USAR supplement is an adequate summary description of the program in accordance with 10 CFR 54.21(d).

Conclusion. On the basis of its technical review of the applicant's Water Chemistry Control - Auxiliary Systems and the applicant's responses to the related RAIs, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so the intended functions will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concludes that it provides an adequate summary description of the program in accordance with 10 CFR 54.21(d).

3.0.4 Quality Assurance Program Attributes Integral to Aging Management Programs

3.0.4.1 Summary of Technical Information in Application

In Appendix A, "Updated Safety Analysis Report Supplement," Section A.1.1., "Aging Management Programs," and Appendix B, "Aging Management Programs and Activities," Section B.0.3, "Corrective Actions, Confirmation Process and Administrative Controls," of the LRA, the applicant described the elements of corrective action, confirmation process, and administrative controls that are applied to the AMPs for both safety-related and nonsafety-related components. The CNS QA Program is used which includes the elements of corrective action, confirmation process, and administrative controls. Corrective actions, confirmation process, and administrative controls are applied in accordance with the QA Program regardless of the safety classification of the components. Section A.1.1 and Section B.0.3, of the LRA state that the QA Program implements the requirements of 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," and is in accordance with the NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants (SRP-LR)," Revision 1.

3.0.4.2 Staff Evaluation

In accordance with 10 CFR 54.21(a)(3), an applicant is required to demonstrate that the effects of aging on SCs subject to an AMR will be adequately managed so that their intended functions will be maintained consistent with the CLB for the period of extended operation. The SRP-LR, BTP RLSB-1, "Aging Management Review - Generic," describes 10 attributes of an acceptable AMP. Three of these 10 attributes are associated with the QA activities of corrective action, confirmation process, and administrative controls. Table A.1-1, "Elements of an Aging Management Program for License Renewal," of BTP RLSB-1 provides the following description of these quality attributes:

- Attribute No. 7 - Corrective Actions, including root cause determination and prevention of recurrence, should be timely.
- Attribute No. 8 - Confirmation Process, should ensure that preventive actions are adequate and that appropriate corrective actions have been completed and are effective.
- Attribute No. 9 - Administrative Controls, should provide a formal review and approval process.

The SRP-LR, BTP IQMB-1, "Quality Assurance for Aging Management Programs," states that those aspects of the AMP that affect quality of safety-related SSCs are subject to the QA requirements of 10 CFR Part 50, Appendix B. Additionally, for nonsafety-related SCs subject to an AMR, the applicant's existing 10 CFR Part 50, Appendix B QA Program may be used to address the elements of corrective action, confirmation process, and administrative control. BTP IQMB-1 provides the following guidance with regard to the QA attributes of AMPs:

> Safety-related SCs are subject to Appendix B to 10 CFR Part 50 requirements which are adequate to address all quality related aspects of an AMP consistent with the CLB of the facility for the period of extended operation. For nonsafety-related SCs that are subject to an AMR for license renewal, an applicant has an option to expand the scope of its Appendix B to 10 CFR Part 50 program to include these SCs to address corrective action, confirmation process, and administrative control for aging management during the period of extended operation. In this case, the applicant should document such a commitment in the Final Safety Analysis Report supplement in accordance with 10 CFR 54.21(d).

The staff reviewed the applicant's AMPs described in Appendix A and Appendix B of the LRA, and the associated implementing procedures. The purpose of this review was to ensure that the QA attributes (corrective action, confirmation process, and administrative controls) were consistent with the staff's guidance described in BTP IQMB-1. Based on the staff's evaluation, the descriptions of the AMPs and their associated quality attributes provided in LRA Appendix A, Section A.1.1, and LRA Appendix B, Section B.0.3, are consistent with the staff's position regarding QA for aging management.

3.0.4.3 Conclusion

On the basis of the staff's evaluation, the descriptions and applicability of the plant-specific AMPs and their associated quality attributes provided in LRA Appendix A, Section A.1.1, and LRA Appendix B, Section B.0.3, were determined to be consistent with the staff's position regarding QA for aging management. The staff concludes that the QA attributes (corrective action, confirmation process, and administrative control) of the applicant's AMPs are in accordance with 10 CFR 54.21(a)(3).

3.1 <u>Aging Management of Reactor Vessel, Reactor Vessel Internals, and Reactor Coolant System</u>

This section of the SER documents the staff's review of the applicant's AMR results for the RV, RVIs, and RCS components and component groups of:

- 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 RV, RVIs, and RCS components and component groups. LRA Table 3.1.1, "Summary of Aging Management Programs for Reactor Vessel, Reactor Vessel Internals, and Reactor Coolant System Evaluated in Chapter IV of the GALL Report," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the RV, RVIs, and RCS components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry OE 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 OE included a review of the GALL Report and OE issues identified since the issuance of the GALL Report.

3.1.2 Staff Evaluation

The staff reviewed LRA Section 3.1 to determine whether or not the applicant provided sufficient information to demonstrate that the effects of aging for the RV, RVIs, and RCS 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, in accordance with 10 CFR 54.21(a)(3).

The staff reviewed the applicant's claim to confirm that certain LRA AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluations of the AMPs are documented in SER Section 3.0.3. Details of the staff's evaluation are documented in SER Section 3.1.2.1.

The staff also reviewed AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the SRP-LR Section 3.1.2.2 acceptance criteria. The staff's evaluations are documented in SER Section 3.1.2.2.

The staff also conducted a technical review of the remaining LRA AMRs not consistent with or not addressed in the GALL Report. The technical review evaluated whether or not all plausible aging effects have been identified and whether or not 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 OE to verify the applicant's claims.

In summary, the staff's review of the RV, RVIs, and RCS component groups followed any one of several approaches. One approach, documented in SER Section 3.1.2.1, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.1.2.2, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.1.2.3, reviewed AMR results for components that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the RV, RVIs, and RCS components is documented in SER Section 3.0.3.

3.1.2.1 AMR Results That Are Consistent with the GALL Report

LRA Section 3.1.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the RV, RVIs, and RCS components (RCPB):

- Bolting Integrity Program
- BWR Control Rod Drive (CRD) Return Line Nozzle Program
- BWR Feedwater (FW) Nozzle Program
- BWR Penetrations Program
- BWR Stress-Corrosion Cracking (SCC) Program
- BWR Vessel Inside Diameter (ID) Attachment Welds Program
- BWR Vessel Internals Program
- Inservice Inspection (ISI) Program
- Reactor Head Closure Studs Program
- Reactor Vessel Surveillance Program
- Water Chemistry Control – BWR Program
- Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program
- External Surfaces Monitoring Program
- Flow-Accelerated Corrosion Program
- One-Time Inspection Program
- One-Time Inspection – Small-Bore Piping Program
- Water Chemistry Control – Closed Cooling Water (CCW) Program

LRA Tables 3.1.2-1 through 3.1.2-3 summarize AMRs for the RV, RVIs, 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 review determined whether or not the plant-specific components of these GALL Report component groups were bounded by the GALL Report evaluation.

The staff reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the RV, RVIs, and RCS components that are subject to an AMR. On the basis of its review, the staff determined that, for AMRs not requiring further evaluation, the applicant's references to the GALL Report are acceptable and no further staff review is required, with the exception of the following AMRs that the applicant had identified were consistent with the AMRs of the GALL Report and for which the staff felt were in need of additional clarification and assessment. The staff provides evaluations of these AMRs in the following sections.

3.1.2.1.1 Cracking Due to Stress-Corrosion Cracking and Intergranular Stress-Corrosion Cracking for Stainless Steel and Nickel Alloy Components Exposed to Reactor Coolant

LRA Table 3.1.1, item 3.1.1-41 addresses cracking due to SCC and IGSCC for stainless steel and nickel alloy piping, piping components, and piping elements greater than or equal to 4 inches NPS (4 inches NPS for a pipe with a 4.5 inch OD designation); nozzle safe ends; and associated welds exposed to reactor coolant.

The LRA credits the ISI Program supplemented by the Water Chemistry Control – BWR Program with managing SCC and IGSCC for the following components: nozzle [MS (N3A-D), CS (N5A/B), jet pump instrument (N8A/B), recirc outlet (N1A/B), recirc inlet (N2A–K)], RV bottom head, RV shell (closure flange), RV shell (lower shell and lower intermediate beltline shell and connecting welds and upper intermediate and upper shell) and the RV upper head (closure flange) fabricated from low-alloy steel with stainless steel clad in a treated water greater than 140 ^{o}F (internal) only. The GALL Report recommends GALL AMP XI.M7, "BWR Stress-Corrosion Cracking" supplemented with GALL AMP XI.M2, "Water Chemistry" to manage this aging effect. The AMR line items that reference this line item cite LRA Note E, indicating a different AMP.

The GALL Report delineated that the components within the scope of license renewal of GALL AMP XI.M7, "BWR Stress-Corrosion Cracking," are all piping and piping welds made of austenitic stainless steel and nickel alloy that is 4 inches or larger in nominal diameter and contains reactor coolant. The staff noted that the components within the applicant's ISI Program supplemented by the Water Chemistry Control – BWR Program for aging management do not fall into the scope of GALL AMP XI.M7. The staff noted that for these components the applicant referenced LRA Table 3.1.1, item 3.1.1-41 because they were of the same material, environment, and aging effect combination (stainless steel, reactor coolant, cracking due to SCC and IGSCC). The staff reviewed ASME Code Section XI subsection IWB-1100 and noted that the components listed above are within the scope of ISI for Class 1 pressure retaining components and their welded attachments in light-water cooled plants; therefore, the ISI Program is appropriate for aging management. Furthermore, the use of the ISI Program for these components is in accordance with 10 CFR 50.55a and the ASME Code Section XI. The staff further noted that the GALL AMP XI.M7 is primarily applicable to stainless steel piping and welds and does not apply to the aforementioned stainless cladding of steel shell and nozzle components.

The staff reviewed the applicant's ISI Program and Water Chemistry Control – BWR Program, and its evaluation is documented in SER Section 3.0.3. The staff finds that the ISI Program is capable of detecting loss of material and cracking for pressure retaining components of the RCPB. The staff noted that in that inspection, repair, and replacement of components within scope of this program are described in Subsections IWB, IWC, and IWD for Class 1, 2 and 3 components, respectively. The staff determined this program will perform periodic visual, surface, and/or volumetric examination and leakage tests of Class 1, 2, and 3 pressure-retaining components and their integral attachments and supports. The staff finds the Water Chemistry Control – BWR Program is capable of mitigating the aging effects of loss of material and cracking that can be caused by corrosion and cracking mechanisms. The staff also finds that this program controls water chemistry to minimize degradation by limiting and maintaining the level of contaminants in the RCS that may cause loss of material and cracking. On the basis that the ISI Program's examination methodology is capable of detecting loss of material and cracking in the subject components and the Water Chemistry Control – BWR Program will limit and maintain the level of contaminants to mitigate aging mechanisms that can cause loss of material and cracking, the staff finds it acceptable for the applicant to credit these programs with aging management.

Based on the programs identified, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.1.2.1.2 Cracking Due to Stress-Corrosion Cracking and Intergranular Stress-Corrosion Cracking in the Non-Class 1 Components

In LRA Table 3.1.2-3, "Reactor Coolant Pressure Boundary," the applicant addressed the AMR items of stainless steel non-Class 1 flow element, instrument snubber, piping and fittings, tubing and valve body that are subject to cracking due to SCC and IGSCC in a treated water environment (greater than 140 °F). However, the plant-specific LRA Note 105 for the table indicated that the non-Class 1 components are less than 4 inches NPS and are not part of the RCPB.

LRA Table 3.2.1, item 3.2.1-18 addressed the listed AMR items; it also indicated that the Water Chemistry Control – BWR Program is used to manage the aging effects of the AMR items and the effectiveness of the program will be confirmed by the One-Time Inspection Program. However, the staff found that in LRA Table 3.1.2-3, the AMR items credited only the Water Chemistry Control – BWR Program, and does not include the One-Time Inspection Program as specified in LRA Table 3.2.1, item 3.2.1-18. Therefore, the staff issued RAI 3.1.2.1-1, by letter dated June 29, 2009, and requested that the applicant clarify whether or not the One-Time Inspection Program will be used in conjunction with the Water Chemistry Control – BWR Program to manage the aging effects for these AMR items. The applicant responded to the RAI by letter dated July 29, 2009. In its response, the applicant stated that in LRA Sections B.1.29 and B.1.39, the One-Time Inspection provides verification of the effectiveness of the Water Chemistry Control – BWR Program for all component, material, and environment combinations that credit the Water Chemistry Control Program. The applicant also stated that this includes the management of cracking as listed in LRA Tables 3.1.2-3, 3.2.2-1, 3.2.2-8-1, 3.2.2-8-3, 3.2.2-8-4, 3.3.2-2, 3.3.2-14-3, 3.3.2-14-13, 3.3.2-14-16, and 3.3.2-14-21. The applicant further stated that a plant-specific note referring to the One-Time Inspection Program is included in the LRA tables wherever the comparable NUREG-1801 line item recommends both the Water Chemistry and One-Time Inspection programs. In addition, the applicant stated that for those line items compared to NUREG-1801 line items that do not specify one-time inspections, the note is not used, even though the One-Time Inspection Program applies wherever the Water Chemistry Program is credited.

As described above, the applicant clarified that although the AMR table does not include the One-Time Inspection Program, the foregoing AMR items credit the One-Time Inspection Program with verifying the effectiveness of the Water Chemistry Control – BWR Program in the aging management of the SCC. Therefore, the RAI and applicant's response to the RAI resolved the staff's concern relating to the absence of the plant-specific note referring to the One-Time Inspection Program for the AMR items.

In addition, the staff reviewed the AMR items in comparison with the relevant sections of the SRP-LR, SRP-LR Table 3.2-1, and GALL Report Volume 2, Table V.D2, item V.D2-29 for the BWR ECCS. In its review, the staff noted the guidance documents recommend that GALL AMP XI.M7, "BWR Stress-Corrosion Cracking Program," and GALL AMP XI.M2, "Water Chemistry Program," manage the aging effect of SCC in the components. Although the applicant indicated that the components are less than 4 inches NPS, the staff noted that the BWR SCC Program is not credited for non-Class 1 components with a nominal diameter of 4 inches or larger. Therefore, the staff is concerned that the aging management approach might be in potential conflict with the criteria of GL 88-01 and BWRVIP-75-A, which are reference documents used in GALL AMP XI.M7, "BWR Stress Corrosion Cracking Program." The staff noted that GL 88-01 and BWRVIP-75-A apply to relevant BWR components 4 inches or larger in nominal diameter, and does not make a distinction for the ASME Code classification including non-Class 1 components.

In its review of the LRA, the staff also found that the BWR SCC Program manages SCC and its effect on the RCPB components, which suggests that the applicant's program mainly manages SCC and its effect on Class 1 components. Therefore, the staff issued RAI B.1.7-6, by letter dated June 29, 2009, requesting that the applicant clarify the following three items:

(1) Whether or not the applicant's program manages SCC and its effect on non-Class 1 components as well as Class 1 components

(2) Whether or not the CNS has non-Class 1 components that are subject to the scope of the GALL Report BWR SCC Program

(3) If the CNS has non-Class 1 components under the scope of the GALL Report BWR SCC Program and the applicant's BWR SCC Program is not credited for the non-Class 1 components, clarify what AMP is used to manage SCC and its effect on non-Class 1 components; provide relevant justification of using a different program.

The applicant responded to the RAI, by letter dated July 29, 2009, and the applicant stated that stress corrosion cracking in non-Class 1 components is not managed by the BWR Stress Corrosion Cracking Program. The applicant also stated that other programs such as the Water Chemistry Control – BWR Program, along with the One-Time Inspection Program to verify the Water Chemistry Program's effectiveness, manage SCC for non-Class 1 components (see the response to RAI B.1.7-3). The applicant further stated that there are no non-Class 1 components subject to the scope of the BWR SCC Program and GL 88-01.

The applicant also referred to its response to RAI B.1.7-3, which was included in a letter dated June 15, 2009. In RAI B.1.7-3, the staff requested that the applicant clarify what portions of ESF and auxiliary systems are managed by the BWR SCC Program. In its response, the applicant stated that: for systems that operate intermittently, the license renewal AMR process conservatively selects the limiting environment for determination of aging effects. The applicant also stated that, for example, portions of the RHR system, which is in standby at ambient temperature during normal operation, will be exposed to temperatures greater than 140 °F when the system operates during shutdowns; so treated water greater than 140 °F is the environment selected. The applicant further stated that parts of the HPCI and RCIC systems, which are also in standby and only operate during testing, are similarly evaluated assuming there is a treated water environment greater than 140 °F."

In addition, the applicant stated that in NUREG-1801, the BWR SCC Program includes all BWR austenitic stainless steel piping that is 4 inches or larger in nominal diameter and contains reactor coolant at a temperature above 200 °F during power operation regardless of ASME Code classification. The applicant also stated that since most RHR, HPCI, and RCIC components are normally in standby at ambient temperatures (less than 200 °F), they are not included in the program. The applicant further stated that the portions of the ESFs and auxiliary systems exposed to reactor coolant at temperatures greater than 200 °F during power operation are Class 1 components evaluated as part of the reactor coolant pressure boundary.

In its responses to RAI B.1.7-3 and RAI B.1.7-6, the applicant clarified that it has no non-Class 1 components subject to the scope of the BWR SCC Program and GL 88-01. The applicant also clarified that other programs such as the Water Chemistry Control– BWR Program, along with the One-Time Inspection Program, to verify the Water Chemistry Program's effectiveness, manage SCC for non-Class 1 components. In relation to foregoing evaluation on the aging management of SCC, the staff's SE of the applicant's AMR review results for the RWCU system piping outboard of the second isolation valve is described in the AMR evaluation section for the RWCU system. Based on the foregoing review results, the staff determines that the RAI responses resolved its concerns regarding the program scope of the BWR SCC Program and aging management of SCC.

The staff also reviewed the Water Chemistry Control – BWR Program and One-Time Inspection Program of the applicant. The review results of the AMPs are documented in SER Section 3.0.3. In its review, the staff finds that the Water Chemistry Program is capable of mitigating the aging effect of cracking that is caused by SCC. The staff also finds that this program controls water chemistry to minimize the environmental degradation of the components by maintaining the relevant water chemistry and limiting the levels of contaminants such as chloride and sulfate that may cause cracking. The staff finds that the One-Time Inspection Program, which performs inspections of selected components including the areas of low or stagnant flow, is capable of detecting cracking due to SCC, if it should occur in the selected components. The staff also finds that the One-Time Inspection Program is adequate to verify whether the aging effect of cracking is progressing very slowly or not occurring in the components so that the intended functions of the components are maintained during the period of extended operation.

On the basis of its review, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.1.2.1.3 Cracking Due to Stress-Corrosion Cracking and Intergranular Stress-Corrosion Cracking in the Control Rod Drive System

In LRA Table 3.1.2-3, page 3.1-54, the applicant addressed the stainless steel CRD in the CRD system that is part of the reactor pressure boundary and is subject to cracking due to SCC or IGSCC in a treated water environment (greater than 140 °F). The applicant credited the ISI Program and Water Chemistry Control – BWR Program for the aging management. The applicant also indicated that the consistency note for the AMR item is LRA Note E, which means that the AMR item is consistent with the GALL Report in terms of component, material, environment, and aging effect, but a different AMP is credited for the aging management. The staff noted that where the GALL Report recommends GALL AMP XI.M7, "BWR Stress-Corrosion Cracking" and GALL AMP XI.M2, "Water Chemistry" the applicant proposed using the ISI Program and the Water Chemistry Control – BWR Program. In LRA Table 3.1-1, item 41, the applicant further indicated that for those components for which the BWR SCC Program is not applicable, cracking is managed by the Water Chemistry Control – BWR Program and either the ISI Program or the One-Time Inspection Program.

The staff reviewed the applicant's AMR results in comparison with SRP-LR Table 3.1-1, item 41, SRP-LR Section 3.1.2.1 and GALL Report, Volume 2, Table IV.C1, item IV.C1-9. The staff also reviewed the AMR item in comparison with the GALL Report BWR SCC Program and Water Chemistry Program for this AMR item. In its review, the staff found that a potential conflict between the recommendations of NRC GL 88-01 and the applicant's aging management approach as cited in the GALL Report BWR SCC Program. During its review, the staff found that the CRDM piping, as part of the RCPB, is to be managed in accordance with the BWR SCC Program and related recommendations of GL 88-01.

Therefore, the staff issued RAI 3.1.2.1-2, by letter dated June 29, 2009, requesting that the applicant clarify why this AMR item does not credit the BWR SCC Program although this item is regarded to be in the scope of the program based on the applicant's claim of being consistent with LRA Note E. The staff also requested that the applicant provide justification as to how the ISI Program, in conjunction with the Water Chemistry Control Program, can provide adequate aging management for the AMR item. The applicant responded to the RAI by letter dated July 29, 2009, and the applicant stated that the component type, "control rod drive" in LRA Table 3.1.2-3, on page 3.1-54, refers to the control rod hydraulic drive unit, mounted on the control rod housings below the RV. The applicant also stated that the drive unit is stainless steel and is part of the reactor coolant pressure boundary, but it is not a component type subject to IGSCC within the scope of the BWR SCC Program and GL 88-01.

The applicant further stated that NUREG-1801 does not recognize the control rod hydraulic drive unit as a component. In addition, the applicant stated that NUREG-1801, line item IV.C1-9 provided the closest comparable aging management results for this material, environment, aging effect combination. The applicant stated that LRA Note E was used to denote that an AMP different from that recommended in IV.C1-9 was credited and LRA Note E does not imply that the component is consistent with those listed in NUREG-1801.

The applicant further stated that although the BWR SCC Program does not apply to the CRD hydraulic drive units, the ISI Program requirements for this Class 1 component, in conjunction with water chemistry, appropriately manage cracking through the use of periodic inspections and control of water chemistry, thus reducing the potential for these aging effects.

As described above, the applicant clarified that the component type, "control rod drive" in LRA Table 3.1.2-3, on page 3.1-54, refers to the control rod hydraulic drive unit and GALL Report Volume 2, item IV.C1-9 provides the closest comparable aging management results for this material, environment, aging effect combination. The applicant also clarified that LRA Note E was used to denote that an AMP different from that recommended in GALL Report, item IV.C1-9 was credited and although the BWR SCC Program does not apply to the CRD hydraulic drive units, the ISI Program requirements for this Class 1 component, in conjunction with water chemistry, appropriately manage cracking through the use of periodic inspections and control of water chemistry.

The staff reviewed the ISI Program and Water Chemistry Control – BWR Program in the LRA. The review results of the AMPs are documented in SER Section 3.0.3. The staff finds that the ISI Program can adequately detect and manage cracking, loss of material, and reduction of fracture toughness to ensure the integrity of the RPV and coolant system components. The staff also finds that the Water Chemistry Control – BWR Program optimizes the water chemistry to minimize the potential for cracking due to SCC. Therefore, the staff determines that the ISI Program and Water Chemistry Control – BWR Program are adequate to manage the aging effect of the AMR item.

On the basis of its review, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable component. The staff concludes that the applicant has demonstrated that the effects of aging for the component will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.1.2.1.4 Cracking Due to Stress Corrosion Cracking and Intergranular Stress Corrosion Cracking in the Reactor Vessel Main Steam Nozzle

In LRA Table 3.1.2-1, page 3.1-38, the applicant addressed the RV MS low-alloy steel nozzle with partial stainless steel clad that is subject to cracking due to SCC and IGSCC in a treated water environment (greater than 140 °F). The applicant credited the ISI Program and Water Chemistry Control – BWR Program for the aging management. The applicant also indicated that the consistency note for the AMR item is LRA Note E, which means that a different AMP is credited for the aging management of this AMR item. The staff noted that where the GALL Report recommends GALL AMP XI.M7, "BWR Stress-Corrosion Cracking" and GALL AMP XI.M2, "Water Chemistry" the applicant proposed using the ISI Program and the Water Chemistry Control – BWR Program. In LRA Table 3.1-1, item 41, the applicant further indicated that for those components for which the BWR SCC Program is not applicable, cracking is managed by the Water Chemistry Control – BWR Program and either the ISI Program or the One-Time Inspection Program.

The staff reviewed the applicant's AMR results in comparison with SRP-LR Table 3.1-1, item 41, SRP-LR Section 3.1.2.1 and GALL Report, Volume 2, Table IV.A1, item IV.A1-1. In its review, the staff found that the AMR item of the GALL Report, which the applicant credited, is mainly for the aging management of stainless steel or nickel alloy RV nozzle safe ends in BWR and does not specifically include the MS nozzle. However, the staff also found that the AMR item, which the applicant credited, is most similar to the MS nozzle component especially in comparison with the other items in GALL Report, Volume 2, Table IV.A1 that addresses the BWR RV components.

In addition, the staff noted that the applicant credited the ISI Program in conjunction with the Water Chemistry Control – BWR Program. In its review, the staff finds that that the ISI Program reveals cracking and leakage of coolant through the periodic visual, surface and/or volumetric inspections prescribed in the AMP and performs relevant repairs in compliance with the ASME Code Section XI. Therefore, the staff determines that the ISI Program, with the Water Chemistry Program, is adequate to manage the aging effect in terms of the detection of the aging effect, confirms the effectiveness of the Water Chemistry Program and further corrective actions as required. The staff also finds that the implementation of the Water Chemistry Program – BWR for the aging management is adequate in accordance with the guidance documents.

The staff reviewed the ISI Program and Water Chemistry Control – BWR Program in the LRA. The review results of the AMPs are documented in SER Section 3.0.3. The staff finds that the ISI Program can adequately detect and manage cracking, loss of material, and reduction of fracture toughness to ensure the integrity of the RPV and coolant system components. The staff also finds that the Water Chemistry Control – BWR Program optimizes the water chemistry to minimize the potential for cracking due to SCC. Therefore, the staff determines that the ISI

Program and Water Chemistry Control – BWR Program are adequate to manage the aging effect of the AMR item.

On the basis of its review, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable component. The staff concludes that the applicant has demonstrated that the effects of aging for the component will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.1.2.1.5 Cracking Due to Stress-Corrosion Cracking, Intergranular Stress-Corrosion Cracking, and Irradiation Assisted Stress-Corrosion Cracking in the Local Power Range Monitors

In LRA Table 3.1.2-2, page 3.1-48, and LRA Table 3.1.1, item 3.1.1-44, the applicant addressed the stainless steel pressure boundary for the local power range monitors (LPRMs) that are subject to cracking due to SCC, IGSCC, and IASCC in a treated water environment (greater than 140 °F). The applicant credited the ISI Program (LRA Section B.1.19) and Water Chemistry Control – BWR Program for the aging management. The applicant also indicated that the consistency note for the AMR item is LRA Note E, which means that a different AMP is credited for this AMR item. The staff noted that where the GALL Report recommends GALL AMP XI.M9, "BWR Vessel Internals" and GALL AMP XI.M2 "Water Chemistry" the applicant proposed using the ISI Program and the Water Chemistry Control – BWR Program.

The staff reviewed the applicant's AMR results in comparison with SRP-LR Table 3.1-1, item 44, SRP-LR Section 3.1.2.1 and GALL Report, Volume 2, Table IV.B1, item IV.B1-10. In its review, the staff verified that the AMR item for the LPRM pressure boundary is consistent with the GALL Report item for material, environment, and aging effect as the applicant indicated. In its review, the staff noted that the GALL Report recommends the BWR Vessel Internals Program and Water Chemistry Program for the BWR water to manage the SCC of the RV instrumentation, such as incore flux monitor guide tubes and intermediate range monitor dry tubes. The staff also found that in the LRA Table 3.1.2-2, page 3.1-48, the applicant credited the recommended AMPs for the aging management of the guide tubes of the incore flux monitors.

In its review, the staff found that the LPRMs pressure boundary are within the scope of the ISI Program and the pressure test of the ISI Program is adequate to detect and manage the aging effect of the AMR item as described in LRA Table 3.1.1, item 3.1.1-44 because the pressure test can detect leakage that would indicate the presence of a thru-wall flaw, if it should exist, and relevant corrective actions can adequately manage the aging effect of the AMR item. Therefore, the staff determines that the ISI Program is an acceptable method in conjunction with the Water Chemistry Control Program for the aging management of the AMR item.

The staff also reviewed the ISI Program and Water Chemistry Control – BWR Program in the LRA. The review results of the AMPs are documented in SER Section 3.0.3. The staff finds that the ISI Program can adequately detect and manage cracking, loss of material, and reduction of fracture toughness to ensure the integrity of the RPV and coolant system components. The staff also finds that the Water Chemistry Control – BWR Program optimizes the water chemistry to minimize the potential for cracking and loss of material. Therefore, the staff finds that the ISI Program and Water Chemistry Control – BWR Program are adequate to manage the aging effect of the AMR item.

On the basis of its review, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable component. The staff concludes that the applicant has demonstrated that the effects of aging for the component will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.1.2.1.6 Loss of Material in the Shroud Support and in the Jet Pump Assemblies Hold-down Beam and Diffuser Adapter Bottom Piece

In LRA Table 3.1.2-2, page 3.1-52, and Table 3.1.1, item 3.1.1-47, the applicant indicated that the RV nickel alloy shroud support is subject to loss of material due to pitting and crevice corrosion. The applicant also indicated that the consistency note of the AMR item is LRA Note E, which means that a different AMP is credited in comparison with the GALL Report.

In LRA Table 3.1.1, item 3.1.1-47, the applicant indicated that loss of material in the shroud support is managed by the Water Chemistry Control – BWR Program and the effectiveness of the Water Chemistry Program will be confirmed by the One-Time Inspection Program. The applicant also indicated that the ISI Program is not applicable to most RVI components (to manage loss of material) since they are not part of the pressure boundary. The applicant credited the same AMPs, Water Chemistry Control – BWR Program and One-Time Inspection Program, for the nickel alloy jet pump assemblies as described in LRA Table 3.1.2-2, page 3.1-50.

The staff reviewed the technical information of the LRA in comparison with SRP-LR Table 3.1-1, item 47 and GALL Report, Volume 2, Table IV.B1, item IV.B1-15. In its review, the staff found that the GALL Report recommends the ASME Code Section XI ISI, Subsections IWB, IWC, and IWD Program, as well as the Water Chemistry Program for the aging management of the AMR items.

The staff also reviewed the ISI Program in comparison with the ASME Code Section XI, ISI Program of the GALL Report. In its review, the staff found that the Program Description and OE sections of the applicant's ISI Program stated that the program manages loss of material, as well as cracking and reduction of fracture toughness, which is consistent with the ISI Program of the GALL Report. In addition, the staff found that the ASME Code Section XI ISI requires periodic visual inspections for integrally welded core support structures and interior attachments to RVs as described in the Examination Category B-N-2.

The staff issued RAI 3.1.2-1, by letter dated May 1, 2009, requesting that the applicant clarify why the foregoing AMR item (shroud support) does not credit periodic inspections to detect and monitor loss of material for the component during the period of extended operation, even though the ASME Code Section XI ISI requires periodic visual inspections and the ISI Program of the applicant indicates that loss of material is one of the aging effects that the program manages.

The applicant responded to the RAI by letter dated on July 29, 2009, and stated that CNS performs periodic visual inspections of integrally welded core support structures and interior attachments to the RV, as prescribed in ASME Section XI, Inservice Inspection (ISI) Examination Category B-N-2. The applicant also stated that theses inspections could be credited, along with water chemistry, to manage loss of material for the portions of the shroud support inspected under the ISI Program. The applicant further stated that, however, for consistency with the management of loss of material for the remainder of the vessel internals (including portions of the shroud support not subject to ISI), only water chemistry and the one-time inspection programs are credited.

The applicant clarified that the inspection for Examination Category B-N-2 is performed on the portions of core shroud support in the applicant's AMP. The reason why only the Water

Chemistry and One-Time Inspection programs are credited for the shroud support in the AMR table is to maintain the consistency with the remainder of the vessel internals that credit the same programs in managing loss of material. Therefore, the staff finds that the applicant's AMP performs Examination Category B-N-2 inspections on the core shroud support and the Water Chemistry and One-Time Inspection programs are also credited to manage loss of material of the shroud support and jet pump assemblies.

In its review, the staff finds the Water Chemistry Program is capable of mitigating the aging effect of loss of material that can be caused by corrosion. The staff also finds that this program controls water chemistry to minimize the environmental degradation of the components by maintaining the relevant water chemistry and limiting the levels of contaminants in the RCS that may cause loss of material. The staff finds that the One-Time Inspection Program, which performs inspections of selected components including the areas of low or stagnant flow, is capable of detecting loss of material due to general, pitting, and crevice corrosion, if it should occur in the selected components. The staff also finds that the One-Time Inspection Program is adequate to verify whether or not the aging effect of loss of material is occurring or is occurring very slowly in the components so that the intended functions of the components are maintained during the extended period of operation

On the basis of its review, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.1.2.1.7 Loss of Material for Reactor Vessel Internals Exposed to Reactor Coolant

LRA Table 3.1.1, item 3.1.1-47 addresses loss of material due to pitting and crevice corrosion for stainless steel RVIs exposed to reactor coolant in the RVIs.

The LRA credits the Water Chemistry Control – BWR Program, supplemented by the One-Time Inspection Program, to manage this aging effect for stainless steel control rod guide tubes (tube and thermal sleeve), CS lines, core plate assembly and hold-down bolts, fuel support orifices, incore flux monitors (guide tubes and LPRMs), jet pump assemblies, shroud, steam dryer and top guide assembly in a treated water greater than 140 ^{o}F (internal) environment only. The GALL Report recommends GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" and GALL AMP XI.M2, "Water Chemistry" to manage this aging effect. The AMR items that reference this line item cite LRA Note E, indicating that a different AMP is credited.

The staff noted that the components within the scope of the ISI Program as defined by IWB-1100 of the ASME Code Section XI, are Class 1 pressure retaining components and their welded attachments in light-water cooled plants. The staff noted that these components described in the paragraph above do not have an intended function of "pressure boundary," therefore they do not fall within the scope of the ISI Program. The staff further noted that items #14 and #15 in Table 1 of the GALL Report, Volume 1, manage loss of material due to pitting and crevice corrosion for stainless steel exposed to reactor coolant water. For these components, the GALL Report recommends the use of GALL AMP XI.M2, "Water Chemistry" and GALL AMP XI.M32, "One-Time Inspection." The staff determined that because the above mentioned components are not within the scope of the ISI Program, as defined in the ASME Code Section XI, that it is inappropriate to credit the ISI Program for aging management. The staff further determined that the use of the Water Chemistry Control – BWR and the One-Time

Inspection programs is consistent with recommendations of the GALL Report for managing loss of material due to pitting and crevice corrosion for stainless steel exposed to reactor coolant water.

The staff reviewed the applicant's Water Chemistry Control – BWR Program and One-Time Inspection Program and its evaluation is documented in SER Section 3.0.3. The staff determined that the Water Chemistry Control – BWR Program manages aging effects caused by loss of material due to corrosion. The staff further determined that this program relies on monitoring and water chemistry based on industry guidance in order to maintain the primary water chemistry to minimize the potential for loss of material and cracking, which is done by limiting levels of contaminants that can cause loss of material and cracking. The staff determined the One-Time Inspection Program will utilize visual inspections or NDE techniques of a representative sample to verify the effectiveness of the Water Chemistry Control – BWR Program. The staff determined that maintaining water chemistry in these systems will be capable of mitigating loss of material and cracking and that the one-time inspection will provide verification of the program's effectiveness.

Based on the programs identified, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 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 RV, RVIs, 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 SCC and IGSCC
- crack growth due to cyclic loading (pressurized water reactor (PWR), not applicable)
- loss of fracture toughness due to neutron irradiation embrittlement and void swelling (PWR, not applicable)
- cracking due to SCC (PWR, not applicable)
- cracking due to cyclic loading
- loss of preload due to stress relaxation (PWR, not applicable)
- loss of material due to erosion (PWR, not applicable)

- cracking due to flow-induced vibration
- cracking due to SCC and IASCC (PWR, not applicable)
- cracking due to primary water SCC (PWR, not applicable)
- wall thinning due to flow-accelerated corrosion (PWR, not applicable)
- changes in dimensions due to void swelling (PWR, not applicable)
- cracking due to SCC and primary water SCC (PWR, not applicable)
- cracking due to SCC, primary water SCC, and IASCC (PWR, not applicable)
- QA for aging management of nonsafety-related components

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which the report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether or not 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 provides its review of the applicant's further evaluation in the following sections.

3.1.2.2.1 Cumulative Fatigue Damage

In LRA Section 3.1.2.2.1, the applicant indicated that fatigue is considered a TLAA as defined in 10 CFR 54.3 for the RV, selected components of the RVIs and most components of the RCPB, and TLAAs are evaluated in accordance with 10 CFR 54.21(c)(1). In LRA Table 3.1.1, the applicant identified AMR lines 3.1.1-1 through 3.1.1-5 as TLAA items for the RCS, the RV, and the RVIs. The applicant performed cumulative fatigue evaluations for these components.

The applicant indicated in LRA Table 3.1.1 that AMR line items 3.1.1-6 through 3.1.1-10 are applicable to pressurized water reactors (PWRs) only. The staff reviewed these AMR items in the SRP-LR and in the GALL Report and agrees with the applicant's determination that these line items do not apply to CNS, a BWR design plant. SER Section 4.3 documents the staff's review of the applicant's evaluation of TLAA for these components.

In reviewing LRA Table 3.1.2-1 through Table 3.1.2-3, the staff found that the applicant indicated all items subject to metal fatigue TLAA are consistent with the GALL Report, as identified by referencing LRA Notes A and C. Two of the items cited with LRA Note A also are cited with LRA Note 101, which states "This item is considered a match to NUREG-1801 even though the environments are different because the aging effect of cracking due to fatigue is independent of the environment." The staff did not agree with this statement since for most metals fatigue cracking is strongly affected by environmental conditions. During a teleconference call, on September 29, 2009, the staff discussed this issue with the applicant. In the teleconference, the applicant replied that LRA Note 101 was intended for the specific environment condition where the affected components are operated in neutral environment (indoor air) which has negligible influence on fatigue life. Under that specific condition, the staff found the applicant's explanation acceptable. This was substantiated by the fact that in LRA Section 4.3.3, the applicant has addressed the environmental effect on fatigue in a corrosive light-water reactor environment.

The staff reviewed LRA Table 3.1.2-1 through Table 3.1.2-3 and noted that the components cited with LRA Note 101 are operating under the indoor air environments whereas the corresponding components shown in the GALL Report are operating under the reactor coolant environment. Based on its review, the staff found the discrepancy in the environment in this case is acceptable because indoor air is a much less aggressive environment than the reactor coolant.

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 selected criteria in SRP-LR Section 3.1.2.2.2. The staff provides its evaluation as follows.

LRA Section 3.1.2.2.2, item 1 addresses loss of material due to general, pitting, and crevice corrosion in steel components of the RPV exposed to an environment of reactor coolant. The applicant indicated that it will manage the effects of aging with the Water Chemistry Control – BWR Program and this will be augmented by the One-Time Inspection Program. The applicant further indicated that the one-time inspection will verify the effectiveness of the Water Chemistry Control – BWR Program by inspecting a representative sample of components including areas of stagnant flow.

The staff reviewed LRA Section 3.1.2.2.2, item 1 against the criteria in SRP-LR Section 3.1.2.2.2, item 1, which indicates that loss of material due to general, pitting, and crevice corrosion can occur for steel stop head enclosure (without cladding) top head nozzles (vent, top head spray, RCIC, and spare) exposed to reactor coolant. The SRP-LR indicates that control of water chemistry is relied upon to mitigate corrosion, but this does not preclude loss of material at locations of stagnant flow. Therefore, the effectiveness of the Water Chemistry Control Program should be verified to ensure that degradation is not occurring. The SRP-LR further indicates a one-time inspection of select components is an acceptable method to verify whether an aging effect is not occurring or an aging effect is progressing very slowly so that the component's intended function will be maintained during the period of extended operation.

The staff noted that the component's crediting these programs for aging management are the RV upper head-top head (dome), nozzle safe ends greater than or equal to 4 inches (FW (N4A/D) and MS (N3A/D)), nozzle (head) flanges (blank flanges (N6A/B) and nozzle flanges (N6A/B, N7)), nozzles (Head vent (N7) and Spare (N6A/B)) and RVI attachment welds (dryer hold-down brackets), which have referenced LRA Table 3.1.1, item 3.1.1-11 and GALL Report, item IV.A1-11.

The staff reviewed the applicant's Water Chemistry Control – BWR Program and One-Time Inspection Program, and the staff's evaluation of these programs is documented in SER Section 3.0.3. The staff finds the Water Chemistry Control – BWR Program is capable of mitigating the aging effects of loss of material and cracking that can be caused by corrosion and cracking mechanisms. The staff also finds that this program controls water chemistry to minimize degradation by limiting and maintaining the level of contaminants in the RCS that may cause loss of material and cracking. The staff finds that the One-Time Inspection Program includes provisions for inspecting selected components in areas of low or stagnant flow and that it is capable of detecting loss of material due to general, pitting, and crevice corrosion, if it should occur in the selected components. On the basis that the Water Chemistry Control – BWR Program will limit and maintain the level of contaminants to mitigate aging mechanisms that can cause loss of material, this program is supplemented with a one-time inspection of selected components in areas of low or stagnant flow and that the programs credited for aging management are consistent with the recommendations of the GALL Report, the staff finds the use of these programs acceptable.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.2, item 1 criteria. For those line items that apply to LRA Section 3.1.2.2.2, item 1, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

LRA Section 3.1.2.2.2, item 2 covers only BWR isolation condenser components. CNS does not have BWR isolation condenser components. This item is not applicable for CNS.

LRA Section 3.1.2.2.2, item 3 addresses loss of material due to general, pitting, and crevice corrosion in stainless steel (including CASS), nickel alloy and steel with stainless steel clad components exposed to an environment of reactor coolant. The applicant indicated it will manage the effects of aging with the Water Chemistry Control – BWR Program and this will be augmented by the One-Time Inspection Program. The applicant further indicated that the one-time inspection will verify the effectiveness of the Water Chemistry Control – BWR Program by inspecting a representative sample of components including areas of stagnant flow.

The staff reviewed LRA Section 3.1.2.2.2, item 3 against the criteria in SRP-LR Section 3.1.2.2.2, item 3, which indicates that loss of material due to general, pitting, and crevice corrosion can occur for 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 SRP-LR indicates that control of water chemistry is relied upon to mitigate corrosion, but this does not preclude loss of material at locations of stagnant flow. Therefore, the effectiveness of the Water Chemistry Control Program should be verified to ensure that degradation is not occurring. The SRP-LR further indicates a one-time inspection of selected components is an acceptable method to verify whether or not an aging effect is occurring or progressing very slowly so that the component's intended function will be maintained during the period of extended operation.

The staff noted that the components crediting these programs for aging management are flanges, nozzles, penetrations, pressure housings, safe ends, vessel shells, heads and welds, piping, piping components, piping elements, and RCPB components which are referenced in LRA Table 3.1.1, items 3.1.1-14 and 3.1.1.-15 and GALL Report items IV.A1-8 and IV.C1-8, respectively.

The staff reviewed the applicant's Water Chemistry Control – BWR Program and One-Time Inspection Program, and the staff's evaluation of these programs is documented in SER Section 3.0.3. The staff finds the Water Chemistry Control – BWR Program is capable of mitigating the aging effects of loss of material and cracking that can be caused by corrosion and cracking mechanisms. The staff also finds that this program controls water chemistry to minimize degradation by limiting and maintaining the level of contaminants in the RCS that may cause loss of material and cracking. The staff finds that the One-Time Inspection Program includes provisions for inspecting selected components in areas of low or stagnant flow and is capable of detecting loss of material due to general, pitting, and crevice corrosion, if it should occur in the selected components. On the basis that the Water Chemistry Control – BWR Program will limit and maintain the level of contaminants to mitigate aging mechanisms that can cause loss of material, this program is supplemented with a one-time inspection of inspect selected components in areas of low or stagnant flow and that the programs credited for aging management are consistent with the recommendations of the GALL Report, the staff finds the use of these programs acceptable.

Loss of Material in the Core ΔP/SLC Instrumentation Nozzles and in the Nozzle to Safe End Welds for Core Spray, Jet Pump Instrument, and Recirculation Inlet/Outlet. In LRA Table 3.1.2-1, page 3.1-36, the applicant indicated that the RV nickel alloy nozzles for core ΔP/SLC and instrumentation are subject to loss of material in a treated water environment. In LRA Table 3.1.2-1, page 3.1-41, the applicant also indicated that the nozzle to safe end welds for the CS, jet pump instrument, and recirculation inlet/outlet are subject to loss of material in a treated water environment. The LRA indicates that the Water Chemistry Control – BWR Program (LRA Section B.1.39) is used to manage the aging effect of the AMR items and the effectiveness of the Water Chemistry Program will be verified by the One-Time Inspection Program (LRA Section B.1.29). In the applicant's AMR, the LRA consistency note for the AMR items is LRA Note A, which means that the item is consistent with the GALL Report for the component, aging effect and material, environment, and aging management program (MEAP).

In LRA Table 3.1.1, item 3.1.1-14 and Section 3.1.2.2.2, the applicant indicated that loss of material is due to pitting and crevice corrosion and further evaluation is recommended to detect the aging effect. In LRA Section 3.1.2.2.2, the applicant also indicated that the effectiveness of the Water Chemistry Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting the program including areas of stagnant flow.

The staff reviewed the applicant's AMR results on the nickel alloy nozzles and nozzle to safe end welds in comparison with SRP-LR Table 3.1-1, item 14 and Section 3.1.2.2.2. The staff also compared the AMR results with GALL Report, Volume 2, Table IV.A1, item IV.A1-8. In its review, the staff found the adequacy of the AMR items and review results in accordance with the SRP-LR and the GALL Report. In addition, the staff noted that in relation to the AMR items, the SRP-LR indicates that the Water Chemistry Program, the effectiveness of which will be verified by a one-time inspection, is acceptable to determine whether or not corrosion is occurring or progressing very slowly so that the component's intended function will be maintained during the period of extended operation.

The staff also reviewed the Water Chemistry Control – BWR Program and One-Time Inspection Program of the applicant. The review results of the AMPs are documented in SER Section 3.0.3. In its review, the staff finds the Water Chemistry Program is capable of mitigating the aging effect of loss of material that can be caused by corrosion. The staff also finds that this program controls water chemistry to minimize the environmental degradation of the components by maintaining the relevant water chemistry and limiting the levels of contaminants in the RCS that may cause loss of material. The staff finds that the One-Time Inspection Program, which performs inspections of selected components, including the areas of low or stagnant flow, is capable of detecting loss of material due to general, pitting, and crevice corrosion, if it should occur in the selected components. The staff also finds that the One-Time Inspection Program is adequate to verify whether or not the aging effect of loss of material is occurring very slowly in the components so that the intended functions of the components are maintained during the extended period of operation.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.2, item 3 criteria. For those line items that apply to LRA Section 3.1.2.2.2, item 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 functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 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 criteria in SRP-LR Section 3.1.2.2.3 as follows:

(1) LRA Section 3.1.2.2.3 indicates 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). LRA Section 4.2 documents the applicant's evaluation of this TLAA.

(2) The applicant indicated that it implemented the staff approved BWRVIP ISP. Fracture toughness properties of ferritic materials are monitored by this program and this program is consistent with the program described in NUREG-1801, Section XI.M31, "Reactor Vessel Surveillance." This program also includes recommendations for maintaining untested capsules in storage for future reinsertion.

LRA Section 3.1.2.2.3, item 1 provides the applicant's discussion on the management of neutron irradiation embrittlement TLAA. The applicant indicated that certain aspects of neutron irradiation embrittlement are TLAAs as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The staff's acceptance of this TLAA is documented separately in SER Section 4.2.

LRA Section 3.1.2.2.3, item 2 provides the applicant's discussion on the management of neutron irradiation embrittlement using the Reactor Vessel Surveillance Program. The applicant has implemented the BWRVIP ISP based on the BWRVIP-78 report and the BWRVIP-86-A report. The staff approved the two BWRVIP reports in an SER dated February 1, 2002. The BWRVIP-116 report incorporates the technical criteria specified in BWRVIP-78 and BWRVIP-86 and extends the ISP to cover the BWR fleet through the period of extended operation.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.3 criteria. For those line items that apply to LRA Section 3.1.2.2.3, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 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 selected criteria in SRP-LR Section 3.1.2.2.4. The staff provides its evaluation as follows:

LRA Section 3.1.2.2.4, item 1 addresses cracking due to SCC and IGSCC in the stainless steel VFLD line. The applicant indicated that the Water Chemistry Control – BWR Program and ISI Program manage cracking due to SCC and IGSCC in the stainless steel VFLD line. The applicant further indicated that the ISI Program uses periodic pressure testing to identify cracking in the line. Furthermore, the One-Time Inspection – Small-Bore Piping Program will verify the effectiveness of these programs, which includes the use of volumetric examination for the detection of cracking.

SRP-LR Section 3.1.2.2.4, item 1 indicates that cracking due to SCC and IGSCC may occur in the stainless steel and nickel alloy BWR top-head enclosure VFLD lines. The GALL Report recommends that a plant-specific AMP be evaluated because existing programs may not be capable of mitigating or detecting cracking due to SCC and IGSCC.

The staff reviewed the applicant's Water Chemistry Control – BWR Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3, found that the applicant's program manages loss of material and cracking by optimizing the primary water chemistry so the environment is not conducive to these aging effects by limiting the concentration of contaminants in the RCS that could cause loss of material and cracking. The staff also noted that the applicant has established HWC and NMCA in order to limit the potential for IGSCC by reducing the DO in the treated water. The staff noted that this program includes actions that will control the water chemistry so that the environment does not promote loss of material and cracking on the stainless steel VFLD line.

The staff reviewed the applicant's ISI Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3, found that the applicant's program includes the requirements of ASME Code Section XI, Subsections IWB, IWC, and IWD which performs periodic visual, surface, and volumetric examination and leakage tests of Class 1, 2, and 3 pressure-retaining components, their integral attachments, and supports. The staff determined that this program manages loss of material, cracking, and reduction of fracture toughness to ensure the pressure boundary functions of the RPV and RCPB. The staff noted that this program includes inspection techniques that are capable of detecting cracking due to SCC and IGSCC on the stainless steel VFLD line.

The staff reviewed the applicant's One-Time Inspection – Small Bore Piping Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3, found that the applicant's program will perform volumetric examinations to manage cracking that includes a sample selected based on susceptibility, inspect-ability, dose considerations, OE, and limiting locations of the total population of ASME Code Class 1 small-bore piping, within the 10 years prior to the period of extended operation. The staff noted that this program includes ASME Code Class 1 piping less than 4 inches NPS, including pipe, fittings, and branch connections. The staff further noted that if evidence of cracking is revealed by these inspections then an evaluation of the inspection results will be performed that will identify the appropriate corrective actions. The staff noted that this program includes inspection techniques that are capable of detecting cracking due to SCC and IGSCC on the small bore piping associated stainless steel VFLD line.

Items 296 and 301, fuel support pieces and top guide assembly, are listed in LRA Table 3.1.2-2, item 3.1.1-44, which addresses cracking due to SCC and IGSCC. The applicant credited the Water Chemistry Control - BWR and the BWR Vessel Internals programs to manage cracking due to the SCC and IGSCC in the stainless steel components. The AMR line items in Table 3.1.2-2 cite LRA Note A for the top guide assembly, and LRA Note C for the fuel support pieces, respectively. LRA Note A indicates that it is consistent with the GALL Report item for component, material, environment, aging effect, and AMP, and the applicant's AMP is consistent with the GALL Report AMP. LRA Note C indicates that component is different, but consistent with the GALL Report item for material, environment, aging effect, and AMP.

For the same reasons stated previously, the ISI Program is not appropriate for these steel components because the intended function of the fuel support pieces and top guide assembly is to provide structural support, not pressure boundary.

From the standpoint of cracking aging management, the AMR line items in Table 3.1.2-2 list these steel components as item 3.1.1-44. The SRP-LR recommends the BWR Vessel Internals and Water Chemistry programs as the appropriate AMPs for item 3.1.1-44.

Therefore, the staff reviewed the applicant's BWR Vessel Internals (LRA Appendix B, B.1.9) and the applicant's Water Chemistry Control programs (LRA Appendix B, B.1.39). The staff verified that, in conjunction with one another, both programs are capable of managing the cracking of the RVI steel components. The staff's evaluations of the BWR Vessel Internals and Water Chemistry Control – BWR programs are documented in SER Section 3.0.3. On the basis that water chemistry control is maintained and inspections/evaluations are conducted per the BWRVIP documents, cracking due to SCC and IGSCC can be managed during the period of extended operation. Hence, the staff finds the applicant's management of the effects of cracking due to SCC and IGSCC of the reactor internal components to be acceptable because it meets the SRP-LR Section 3.1.2.2.4 criteria.

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 functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.1.2.2.5 Crack Growth Due to Cyclic Loading – For PWR only, not applicable for CNS

3.1.2.2.6 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement and VoidSwelling - For PWR only, not applicable for CNS

3.1.2.2.7 Cracking Due to Stress-Corrosion Cracking - For PWR only, not applicable for CNS

3.1.2.2.8 Cracking Due to Cyclic Loading

<u>LRA Section 3.1.2.2.8, item 1</u> addresses cracking due to cyclic loading in stainless steel BWR jet pump sensing lines. The applicant indicated that this section in SRP-LR Section 3.1.2.2.8.1 pertains to the jet pump sensing lines inside the RV. The applicant indicated that the lines at CNS are inside the RV and do not form part of the RCS pressure boundary. Therefore, their failure would not prevent the satisfactory accomplishment of any safety function. The applicant indicated that these jet pump sensing lines inside the RV are not within the scope of license renewal and thus are not subject to an AMR. Furthermore, the lines that are outside the RV are part of the RCS pressure boundary and are subject to an AMR.

SRP-LR Section 3.1.2.2.8 indicates that cracking due to cyclic loading may occur in the stainless steel BWR jet pump sensing lines. The GALL Report recommends that a plant-specific AMP be evaluated to ensure that this aging effect is adequately managed.

The staff reviewed the applicant's statement that the jet pump sensing lines inside the RV are not subject to an AMR. The staff noted that the jet pump sensing lines inside the vessel are not part of the RCPB and that the function of the jet pump sensing lines is only to provide indication of jet pump flow, which is not a license renewal intended function. The staff further noted the failure of these sensing lines would not prevent the completion of a safety-related function. The staff noted that that these jet pump sensing lines are required for plant operation but not required for safe shutdown of the plant. Since the jet pump sensing lines inside the RV are not part of the RCPB and are not required to support a license renewal intended function or whose failure can prevent a license renewal intended function, the staff finds the applicant's statement that jet pump sensing lines inside the RV are not subject to an AMR to be acceptable. This is consistent with the results of the scoping and screening evaluation in SER Section 2.

The staff noted that the lines outside of the RV that are subject to an AMR are listed in LRA Table 3.1.1, item 3.1.1-48. The staff noted that for these lines, the applicant references GALL Report AMR item IV.C1-1, and the GALL Report recommends that the following programs provide aging management of steel and stainless steel Class 1 piping, fittings, and branch connections that are less than 4 inches NPS exposed to reactor coolant: GALL AMP XI.M1, "Inservice Inspection (IWB, IWC, and IWD)," GALL AMP XI.M2, "Water Chemistry," and GALL AMP XI.M35, "One-Time Inspection of ASME Code Class 1 Small-bore Piping." The staff confirmed in the applicant's LRA that stainless steel condensing chambers, piping, fittings, and valve body components less than 4 inches NPS, restriction orifice, thermowell, and tubing components reference LRA Table 3.1.1, item 3.1.1-48 and GALL Report AMR, item IV.C1-1 credit the ISI Program, Water Chemistry Control – BWR Program, and One-Time Inspection – Small-Bore Piping Program for aging management. The staff concludes that this is consistent with the GALL Report recommendations 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).

LRA Section 3.1.2.2.8, item 2 addresses cracking due to cyclic loading for BWR isolation condenser components. CNS does not have isolation condenser components. This item is not applicable for CNS.

3.1.2.2.9 Loss of Preload Due to Stress Relaxation - For PWR only, not applicable for CNS

3.1.2.2.10 Loss of Material Due to Erosion - For PWR only, not applicable for CNS

3.1.2.2.11 Cracking Due to Flow-Induced Vibration

LRA Section 3.1.2.2.11 addresses cracking due to flow-induced vibration in the stainless steel steam dryers. The applicant indicated that the BWR Vessel Internals Program will manage this aging effect and that this program incorporates the inspection recommendations of BWRVIP-139. The applicant further indicated that the Water Chemistry Control – BWR Program will supplement the BWR Vessel Internals Program for aging management.

The staff reviewed LRA Section 3.1.2.2.11 against the criteria in SRP-LR Section 3.1.2.2.11, which indicates that cracking due to flow-induced vibration could occur for the BWR stainless steel steam dryers exposed to reactor coolant. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed.

The staff reviewed the applicant's Water Chemistry Control – BWR Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3, found that the applicant's program manages loss of material and cracking by optimizing the primary water chemistry so the environment is not conducive to these aging effects, by limiting the concentration of contaminants in the RCS that could cause loss of material and cracking. The staff noted that this program includes actions that will control the water chemistry so that the environment does not promote cracking on the stainless steel steam dryers.

The staff reviewed the applicant's BWR Vessel Internals Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3, found that the applicant's program includes: (a) inspection, flaw evaluation, and repair of components that follow the guidance that is provided by the applicable and NRC approved BWRVIP documents and (b) provides monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130 to ensure the long-term integrity of vessel internal components. The staff further found that the BWR Vessel Internals Program includes inspection of the steam dryer that is in accordance with BWRVIP-139 guidance, in which the staff issued its SE on BWRVIP-139 in a letter to EPRI, dated July 30, 2008. In its SE, the staff stated that the guidelines below should be followed for reinspection:

- Each BWR licensee [applicant] will determine the appropriate reinspection approach according to GE SIL-644 or BWRVIP-139 in consideration of the steam dryer performance at its plant.
- License conditions associated with steam dryer monitoring programs in power uprate license amendments take precedence over the steam dryer reinspection provisions in GE SIL-644 or BWRVIP-139.
- The licensee will justify any adjustments to its steam dryer reinspection program where commitments exist to implement the reinspection provisions in GE SIL-644 to support a power uprate license amendment or other activities.
- The licensee is expected to inform the NRC staff of significant changes to its steam dryer reinspection program where the staff relied on the program in a regulatory decision.

Based on the staff's determination that the applicant is implementing the guidelines of BWRVIP-139 as accepted by the staff in its SE, and on the basis that the applicant's BWR Vessel Internals Program incorporates the guidelines of BWRVIP-139, the staff finds the applicant's use of the BWR Vessel Internals Program 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 functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.1.2.2.12 Cracking Due to Stress-Corrosion Cracking and Irradiation Assisted Stress-Corrosion Cracking - For PWR only, not applicable for CNS

3.1.2.2.13 Cracking Due to Primary Water Stress-Corrosion Cracking - For PWR only, not applicable for CNS

3.1.2.2.14 Wall Thinning Due to Flow-Accelerated Corrosion - For PWR only, not applicable for CNS

3.1.2.2.15 Changes in Dimensions Due to Void Swelling - For PWR only, not applicable for CNS

3.1.2.2.16 Cracking Due to Stress-Corrosion Cracking and Primary Water Stress-Corrosion Cracking - For PWR only, not applicable for CNS

3.1.2.2.17 Cracking Due to Stress-Corrosion Cracking, Primary Water Stress-Corrosion Cracking, and Irradiation Assisted Stress-Corrosion Cracking - For PWR only, not applicable for CNS

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.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether or not 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. The staff's evaluation is documented in the following sections.

3.1.2.3.1 Reactor Vessel Closure Flange Bolting Exposed to Air-Indoor (External)

In LRA Table 3.1.2-1, the applicant proposed to manage loss of material for high-strength low-alloy steel reactor vessel closure flange bolting-closure studs, nuts, washers and bushings externally exposed to an indoor air environment using the Reactor Head Closure Studs Program. The AMR line item cites Generic Note H, which indicates that the aging effect is not addressed in the GALL Report for this component, material, and environment combination.

The LRA credits the CNS AMP B.1.32 “Reactor Head Closure Studs Program” to manage this aging effect. The staff's evaluation of the Reactor Head Closure Studs Program is documented in SER Section 3.0.3. The staff reviewed the Reactor Head Closure Studs Program to verify it is an existing CNS program that will manage the loss of material for reactor vessel closure studs, nuts, washers and bushings. The staff also reviewed the GALL report, and found that though there is no GALL line item recommending the management of the loss of material aging effect for BWR Reactor head closure studs and nuts, GALL line item IV.A2-2 manages the loss of material aging effect for PWR Reactor head stud assemblies. The staff noted that the additional AMR line item identified by the applicant exceeds the aging management recommendations of the GALL Report for BWR Reactor head closure studs and nuts, and as a result, the CNS AMP B.1.32 “Reactor Head Closure Studs Program” is conservative in its approach to aging management of loss of material for high-strength low-alloy steel reactor vessel closure flange bolting- closure studs, nuts, washers and bushings externally exposed to an indoor air environment. The staff finds that because these components will be inspected through the specifications of the Reactor Head Closure Studs Program, they will be adequately managed.

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 Low Alloy Steel Bolting and Fasteners Exposed to Air-Indoor (External)

In LRA Table 3.1.2 1, the applicant proposed to manage loss of preload due to thermal effects, gasket creep, and self loosening for low alloy steel bolting and fasteners externally exposed to an indoor environment using the Bolting Integrity Program. The AMR line item cites Generic Note C, which indicates that the component is different, but the line item is consistent with NUREG-1801 item for material, environment, aging effect and aging management program.

In its review of The LRA credits the Bolting Integrity Program to manage this aging effect. The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3. As indicated by the Generic Note C, the line item in the LRA (flange bolts) is different from the line item in the GALL Report item IV.C1-10 (pump and valve closure bolting). However, both items serve the same intended function of pressure boundary, and thus would both experience the loss of preload aging effect described by the GALL Report. The staff noted that the mechanisms identified in the GALL Report as causing loss of preload in carbon steel bolts are thermal effects, gasket creep, and self-loosening, which are not all dependent on the bolting material or environment. The staff also noted that activities in the Bolting Integrity program that control and manage loss of preload are effective for various bolting materials. The Bolting Integrity Program is an existing CNS program that will manage the loss of preload through periodic inspection and preventive measures. The staff reviewed the Bolting Integrity Program to verify that loss of preload due to thermal effects, gasket creep, and self loosening will be managed in accordance with the recommendations specified by the Bolting Integrity Program. On the basis of its review, the staff finds that because these components will be inspected through the specifications of the Bolting Integrity Program, they will be adequately managed.

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, in accordance with 10 CFR 54.21(a)(3).

3.1.2.3.3 Loss of Material from the External Surfaces of Steel Valves Exposed to Indoor Air

LRA Table 3.1.2-3 addresses carbon steel valve bodies less than 4 inches NPS exposed to indoor air on their external surfaces. The applicant proposes that this combination of component and material is not found in the GALL Report (Note G). The applicant further proposes that this combination of environment and material is not subject to aging and that an AMP is not required.

In its review, the staff noted that the applicant's basis for stating that no aging effect was present was that the temperature of the components under consideration was above the dew point. The staff also noted that the GALL Report defines indoor air as an environment in which condensation is only expected on rare occasions (i.e., the dew points of surfaces exposed to indoor air are essentially always above the dew point). The staff further noted that this combination of environment and material is present in the GALL Report, albeit not in the RCS, and that the management of the aging effect "loss of material" is recommended. Lastly, the staff also noted some inconsistencies between plant-specific notes 102 and 104 related to these components, which require clarification.

By letter dated July 14, 2009, the staff issued RAI 3.1.2.3-1 requesting that the applicant clarify the plant-specific notes and justify why aging management is not required for these components given that, during normal plant events (e.g., refueling), the components under consideration will be at or near ambient temperature and may be subject to condensation.

The applicant responded by letter dated August 13, 2009. In its response, the applicant indicated that the temperatures of the components under consideration were normally well above the dew point, precluding condensation and corrosion. The applicant indicated that during the brief periods (outages) where the temperatures of these components were reduced, the probability of condensation and corrosion remained small. The applicant indicated that plant OE showed corrosion had not occurred on these components. Based on its review, the staff finds the applicant's AMP acceptable because corrosion is not expected when the component temperature is above the dewpoint and the duration of time when the component temperature is near the dewpoint is too short to allow significant corrosion to occur even if condensation does occur.

The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.1.2.3.4 Steel Exposed to Air-Indoor (External) with No Aging Effect Requiring Management

In LRA Table 3.1.2-01, the applicant indicated that nozzles (CS (N5A/B), jet pump instrument (N8A/B), recirc outlet (N1A/B), recirc inlet (N2A/K), CRD return (N9), drain (N15), FW (N4A/D), MS (N3A/D), head vent (N7)and spare (N6A/B)), nozzle (head) flanges (blank flanges (N6A/B), nozzle flanges (N6A/B, N7)), nozzle safe ends greater than 4 inches NPS (FW (N4A/D)and MS (N3A/D)), RV bottom head, RV shell (closure flange, lower shell and lower intermediate beltline shell and connecting welds, and upper intermediate and upper shell and RV upper head (closure flange, top-head (dome)) fabricated from low-alloy steel with stainless steel clad, low-alloy steel with partial stainless steel clad, low-alloy steel and carbon steel in an air-indoor (external) environment do not have an aging effect, therefore an AMP is not required. The AMR line items cite LRA Note G, which indicates that the environment is not addressed in the GALL Report for this component and material combination. These AMR line items also indicate that the high component surface temperature precludes moisture accumulation that could result in corrosion.

The staff noted that CNS normally operates at full power with external surface temperatures in excess of 212 ºF (i.e., T greater than 212 ºF) during the 18-month operating cycle. Furthermore, external surfaces operating at temperatures above this threshold drive off moisture and preclude corrosion of the component external surfaces. The staff noted the time period during a RFO when these components are exposed to ambient temperatures is relatively short and corrosion due to atmospheric moisture is not expected to be significant.

The staff reviewed LRA Table IV.IX.D, which provides the following definition for condensation:

> The environment to which the internal or external surface of the component or structure is exposed. Condensation on the surfaces of systems with temperatures below the dew point is considered raw water, due to potential for surface contamination. For the purposes of GALL'05, under certain circumstances, the GALL'01 terms "moist air" or "warm moist air" are enveloped by condensation to describe an environment where there is enough moisture for corrosion to occur.

The GALL Report environment discussed above indicates that the presence of both moisture and cool or warm environmental conditions are necessary for condensation or moisture to occur on component surfaces. A surface environment greater than 212 ºF is hot enough to preclude the precipitation of moisture or condensation, that if otherwise present, might induce corrosive type aging effects (loss of material due to general, pitting, or crevice corrosion or stress corrosion induced cracking). On the basis of its review, the staff finds the applicant has appropriately identified that the above mentioned components are not subject to aging effects requiring management because, during power operations, the high temperature air environment (i.e., greater than 212 ºF) for the steel and alloy steel components will preclude condensation or moisture from occurring on the component surfaces.

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 functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 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 RV, RVIs, and RCS components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.2 Aging Management of Engineered Safety Features

This section of the SER documents the staff's review of the applicant's AMR results for the ESFs components and component groups of:

- residual heat removal
- core spray
- automatic depressurization
- high-pressure coolant injection
- reactor core isolation cooling
- standby gas treatment
- primary containment system
- miscellaneous ESF systems within the scope of license renewal in accordance with 10 CFR 54.4(a)(2)

3.2.1 Summary of Technical Information in the Application

LRA Section 3.2 provides AMR results for the ESF components and component groups. LRA Table 3.2.1, "Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of NUREG-1801," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the ESF components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry OE in the determination of AERMs. The applicant's review of industry OE included a review of the GALL Report and OE issues identified since the issuance of the GALL Report.

3.2.2 Staff Evaluation

The staff reviewed LRA Section 3.2 to determine whether or not the applicant provided sufficient information to demonstrate that the effects of aging for the ESF components within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

The staff conducted a review of AMRs to ensure the applicant's claim that certain AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluations of the AMPs are documented in SER Section 3.0.3. Details of the staff's audit evaluation are documented in SER Section 3.2.2.1.

In the onsite audit, the staff also selected AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the SRP-LR Section 3.2.2.2 acceptance criteria. The staff's review is documented in SER Section 3.2.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with or not addressed in the GALL Report. The technical review evaluated whether or not all plausible aging effects have been identified and whether or not the aging effects listed were appropriate for the material-environment combinations specified. The staff's evaluation is documented in SER Section 3.2.2.3.

For SSCs which the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR line items and the plant's OE to verify the applicant's claims.

In summary, the staff's review of the ESF component groups followed any one of several approaches. One approach, documented in SER Section 3.2.2.1, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.2.2.2, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.2.2.3, reviewed AMR results for components that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the ESF components is documented in SER Section 3.0.3.

3.2.2.1 AMR Results That Are Consistent with the GALL Report

LRA Section 3.2.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the ESF components:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- Selective Leaching Program
- Service Water Integrity Program
- Water Chemistry Control – BWR Program
- Water Chemistry Control – Closed Cooling Water (CCW) Program
- Periodic Surveillance and Preventive Maintenance (PSPM) Program
- Buried Piping and Tanks Inspection Program
- Flow-Accelerated Corrosion Program
- Oil Analysis Program
- One-Time Inspection Program

LRA Tables 3.2.2-1 through 3.2.2-7 and 3.2.2-8-1 through 3.2.2.-8-6 summarize AMRs for the ESF components and indicate AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency with the report and for which it does not recommend further evaluation, the staff's review determined if the plant-specific components of these GALL Report component groups were bounded by the GALL Report evaluation.

The staff reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the ESF components that are subject to an AMR. On the basis of its audit and review, the staff determines that for AMRs not requiring further evaluation, the applicant's references to the GALL Report are acceptable and no further staff review is required, with the exception of the following AMRs that the applicant had identified were consistent with the AMRs of the GALL Report and which the staff felt were in need of additional clarification and assessment. The staff provides its evaluation of these AMRs in the following sections.

3.2.2.1.1 Loss of Material Due to General Corrosion from the Internal Surfaces of Steel Piping, Piping Components, and Piping Elements Exposed to Uncontrolled Indoor Air

LRA Table 3.2.1, item 3.2.1-32 address the loss of material due to general corrosion from the internal surfaces of steel piping, piping components, and piping elements exposed to uncontrolled indoor air. The applicant proposes to manage this aging process through the use of its External Surfaces Monitoring Program (LRA B.1.14) as reviewed in SER Section 3.0.3. The GALL Report recommends that this aging process be managed through the use GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components." The proposed AMP is not consistent with the one recommended by the GALL Report. As a result, the applicant proposes that AMR item 3.2.1-32 is consistent with the GALL Report though a different AMP is credited.

In its review of LRA item 3.2.1-32, the staff noted that the component being considered is the internal surface of piping and ducting managed by the External Surfaces Monitoring Aging Management Program is primarily designed to monitor the condition of external surfaces. The staff further noted that the prediction of internal corrosion based on monitoring external surfaces of the same component is possible only when the interior and exterior environments are identical. Lastly, the staff noted that sufficient information was not provided in the application to permit a determination that the interior and exterior environments of the components under consideration were identical.

By letter dated June 29, 2009, the staff issued RAI 3.2.2.1-2 requesting that the applicant select an AMP designed to monitor the internal surfaces of piping and ducting exposed to uncontrolled indoor air or justify why an external inspection is appropriate to manage internal corrosion. The justification should be sufficient to demonstrate that the environments are identical in terms of items such as coatings, temperature, velocity, humidity, and contaminants.

In its response dated July 29, 2009, the applicant changed the proposed AMP from the External Surfaces Monitoring Program to PSPM Program (reviewed in SER Section 3.0.3). The staff finds the applicant's currently proposed AMP acceptable because the proposed program contains inspection techniques capable of detecting the aging effect under consideration on the internal surfaces of the relevant components being considered.

The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.2.2.1.2 Loss of Material Due to General Corrosion from the Internal Surfaces of Steel Piping, Piping Components, and Piping Elements Exposed to Uncontrolled Indoor Air

LRA and SRP-LR Table 3.2.1, item 3.2.1-32 address the loss of material due to general corrosion from the internal surfaces of steel piping, piping components, and piping elements exposed to uncontrolled indoor air. The applicant proposes to manage this aging process through the use of its Fire Protection Program (LRA B.1.16) as reviewed in SER Section 3.0.3. The GALL Report recommends that this aging process be managed through the use of the GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components." The proposed AMP is not consistent with the AMP proposed by the GALL Report. As a result, the applicant indicated that AMR item 3.2.1-32 is consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited.

In its review of LRA item 3.2.1-32, the staff noted that the aging effect being considered is the loss of material due to general corrosion on the internal surface of piping and ducting. The staff also noted that the scope of the proposed AMP does not include either the internal surfaces of piping in ducting or detection of loss of material due to general corrosion.

By letter dated June 29 2009, the staff issued RAI 3.2.2.1-3 requesting that the applicant select an AMP with a scope that includes detecting loss of material due to general corrosion on the internal surfaces of piping and ducting exposed to uncontrolled indoor air or justify how the currently proposed AMP will adequately address the corrosion of the components under consideration.

In its response dated July 29, 2009, the applicant changed the proposed AMP for the components under consideration from the Fire Protection Program to the PSPM Program (reviewed in SER Section 3.0.3). The staff finds the applicant's currently proposed AMP acceptable because it contains inspection techniques capable of detecting the aging effect under consideration on the internal surfaces of piping.

The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.2.2.1.3 Loss of Material Due to General, Pitting, and Crevice Corrosion from the Internal Surfaces of Steel Piping, Piping Components, and Piping Elements Exposed to Condensation

LRA and SRP-LR Table 3.2.1, item 3.2.1-34 address the loss of material due to general, pitting, and crevice corrosion from the internal surfaces of steel piping, piping components, and piping elements exposed to condensation. The applicant proposes to manage this aging effect through the use of its PSPM Program (LRA B.1.31) as reviewed in SER Section 3.0.3. In contrast, the GALL Report recommends that this aging process be managed through the use of GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components." As a result, the applicant indicated that AMR item 3.2.1-34 is consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited.

In its review of LRA item 3.2.1-34, the staff noted that the aging effect being considered is loss of material from the internal surfaces of piping in the RCIC system. The staff also noted that in the item included in the proposed AMP, the applicant routinely indicated whether the inspections to be performed are internal or external. However, for piping inspections in the RCIC system, the applicant is silent on whether the inspections to be conducted are internal, external, or both.

By letter dated July 14, 2009, the staff issued RAI 3.2.2.1-4 requesting that the applicant specify in the proposed AMP whether the inspections to be conducted of the piping in the RCIC system are internal, external, or both.

In its response dated August 13, 2009, the applicant confirmed that the proposed AMP includes internal visual inspections. The staff finds the applicant's currently proposed AMP acceptable because appropriate inspections are included.

The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.2.2.1.4 Loss of Material Due to General Corrosion for Steel in Air-Indoor Uncontrolled (Internal)

LRA Table 3.2.1, item 3.2.1-32 addresses loss of material due to general corrosion steel piping and ducting components and internal surfaces exposed to air-indoor uncontrolled (internal).

The LRA credits the PSPM Program to manage this aging effect for gray cast iron pump casings in an air-indoor (internal) environment only in the plant drains system. The LRA credits the External Surfaces Monitoring Program to manage this aging effect for gray cast iron valve bodies in an air-indoor (internal) environment only in the N_2 system. However, the GALL Report recommends GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" to manage this aging effect.

The applicant credits the External Surfaces Monitoring Program and the PSPM Program, which take credit for managing loss of material from the external surface for situations where the external and internal material and environment combinations are the same so the external surface is representative of the internal surface condition. However, it is not clear to the staff if the conditions that exist for the internal environment are the same as the external environment. Therefore, by letter dated July 14, 2009, the staff issued RAI 3.3-7 requesting the applicant describe the environmental conditions on the internal surface of these components. The staff further asked the applicant to justify the credited AMPs' ability to manage aging of the internal surface by visually inspecting the external surface. By letter dated August 13, 2009, the applicant responded to the staff's RAI by stating that the gray cast iron pump casings in LRA Table 3.3.2-12, within the plant drains system, refers to a portable gasoline powered pump that is stored indoors and is not a part of an installed system. Therefore, the pump is normally free of water and is exposed to air-indoor (internal). The applicant further indicated that only the external surface is coated; therefore, by letter dated August 13, 2009, the applicant amended LRA Section B.1.31 to state that as part of the PSPM Program, a periodic visual inspection will be performed for the internal and external surfaces of gray cast iron pump casings in the plant drains system. On the basis of its review, the staff finds this portion of the applicant's response acceptable because the applicant will periodically inspect both the internal and external surface for loss of material when exposed to air-indoor.

By letter dated August 13, 2009, the applicant indicated that the gray cast iron valve body components in LRA Table 3.3.2-13, within the N_2 system, along with the associated piping, provide N_2 gas to the drywell. Therefore, these gray cast iron valve body components are exposed to a gas (internal) environment instead of an air-indoor (environment). By letter dated August 13, 2009, the applicant amended LRA page 3.3-153 of LRA Table 3.3.2-13 to state that gray cast iron valve body components are exposed to a gas (internal) environment and, therefore, there is no aging requiring management. The staff noted that the applicant referenced LRA Table 3.3.1, item 3.3.1-97 and GALL AMR item VII.J-23 and used a LRA Note A, which means this AMR line item is consistent with the GALL Report for component, material, environment, aging effect, and AMP. On the basis of its review, the staff finds this portion of the applicant's response to be acceptable because (1) the applicant amended its LRA to accurately describe the gas (internal) environment that these gray cast iron valve body components are exposed to and (2) the applicant is consistent with the recommendations of GALL AMR line item VII.J-23.

The staff reviewed the applicant's PSPM Program and its evaluation is documented in SER Section 3.0.3. The staff determined that the PSPM Program, which includes periodic visual inspections of external surfaces performed during repetitive tasks or routine monitoring of plant operations, is adequate to manage loss of material for gray cast iron piping, piping components, and piping elements exposed to an air-indoor (internal) environment. The staff noted that this program is credited for managing loss of material from the external surface for situations where the external and internal material and environment combinations are the same so that the external surface is representative of the internal surface condition. The staff further noted that these components are located within a building structure and are exposed to air-indoor on the external surface. The staff noted that a visual inspection will be capable of identifying degradation on the external surface that will present itself in signs of corrosion, corrosion byproducts, coating degradation, discoloration on the surface, scale/deposits, and pits and surface discontinuities that are indicative of loss of material.

On the basis of periodic visual inspections being performed during repetitive tasks or routine monitoring of plant operations of these components by the PSPM Program, the staff finds the applicant's use of this program acceptable.

Based on the programs identified, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.2.2.1.5 Loss of material due to pitting, crevice, and microbiologically influenced corrosion of stainless steel piping, piping components, and piping elements exposed to raw water

LRA and SRP-LR Table 3.2.1, item 3.2.1-37 address the loss of material due to pitting, crevice, and microbiologically influenced corrosion of stainless steel piping, piping components, and piping elements exposed to raw water. The applicant proposes to manage this aging process through the use of its One-Time Inspection Program (LRA B.1.29) (reviewed in SER Section 3.0.3). The GALL Report recommends that this aging process be managed through the use of GALL AMP XI.M20, "Open Cycle Cooling Water System." The proposed AMP is not consistent with the AMP proposed by the GALL Report. As a result, the applicant proposes that the AMR item 3.2.1-37 is consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited (LRA note E).

In its review, the staff noted that table 3.2.2-6, which addresses the SGTS, is subordinate to LRA item 3.2.1-37. Based on a review of chapter 2 of the LRA and applicable sections of the USAR, the staff concludes that the applicant incorrectly applied item 3.2.1-37 to describe the SGTS. This conclusion is based on the fact that the SGT fails to meet the scope of the recommended AMP, "Open Cycle Cooling Water." The scope of the open cycle cooling water system is substantially limited to systems which transfer heat from safety-related systems to the ultimate heat sink. There is no evidence that such a function exists in the SGTS. Given that GL 89-13 does not apply to this system, the staff concludes that a visual inspection program, such as that proposed by the applicant, will be effective in managing the aging of the components of this system which are exposed to untreated water.

The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.1.6 Cracking Due to Stress-Corrosion Cracking and Intergranular Stress Corrosion Cracking

In LRA Tables 3.2.2-1, 3.2.2-8-1, 3.2.2-8-3, and 3.2.2-8-4, the applicant addressed stainless steel piping, piping components, and piping elements (cyclone-separator, instrument snubber, piping, tubing, restriction orifice, valve body, and thermowell) in the ESF in relation to LRA item 3.2.1-18 that are subject to cracking due to SCC and IGSCC in a treated water environment (temperature greater than 140 °F). The staff noted that where the GALL Report recommends AMP XI.M7, "BWR Stress-Corrosion Cracking," the applicant proposed using the Water Chemistry Control – BWR Program (LRA Section B.1.39) in conjunction with the One-Time Inspection Program (LRA Section B.1.29) to verify the effectiveness of the Water Chemistry Control Program for the AMR items as described in LRA Table 3.2.1, item 3.2.1-8.

However, the staff found that in LRA Tables 3.2.2-1, 3.2.2-8-1, 3.2.2-8-3, and 3.2.2-8-4, the AMR items credited only the Water Chemistry Control – BWR Program with no additional note for the needed One-Time Inspection Program in contrast to the description in LRA Table 3.2.1, item 3.2.1-18. Therefore, the staff issued RAI 3.1.2.1-1, by letter dated June 29, 2009, and requested the applicant to clarify that the One-Time Inspection Program will be used in conjunction with the Water Chemistry Control – BWR Program to manage the aging effect of the AMR items. The applicant responded to the RAI by letter dated July 29, 2009, and the applicant stated that in LRA Sections B.1.29 and B.1.39, the One-Time Inspection Program provides verification of the effectiveness of the Water Chemistry Control – BWR Program for all component, material, and environment combinations that credit the Water Chemistry Control Program. The applicant also stated that this includes the management of cracking as listed in LRA Tables 3.1.2-3, 3.2.2-1, 3.2.2-8-1, 3.2.2-8-3, 3.2.2-8-4, 3.3.2-2, 3.3.2-14-3, 3.3.2-14-13, 3.3.2-14-16, and 3.3.2-14-21. The applicant further stated that a plant-specific note referring to the One-Time Inspection Program is included in the LRA tables wherever the comparable NUREG-1801 line item recommends both the Water Chemistry Control and One-Time Inspection programs. In addition, the applicant stated that for those line items compared to NUREG-1801 line items that do not specify one-time inspections, the note is not used, even though the One-Time Inspection Program applies wherever the Water Chemistry Control Program is credited.

As described above, the applicant clarified that although the AMR tables do not include a plant-specific note referring to the One-Time Inspection Program, the foregoing AMR items credit the One-Time Inspection Program to verify the effectiveness of the Water Chemistry Control – BWR Program in the aging management of the SCC. Therefore, the applicant's response to the RAI resolved the foregoing issue related to the absence of the plant-specific note referring to the One-Time Inspection Program for the AMR items.

The staff also reviewed the AMR items in comparison with the relevant sections of the SRP-LR, Table 3.2-1, GALL Report, Volume 1, Table 2 and GALL Report, Volume 2, Table V.D2, item V.D2-29. In its review, the staff found that the guidance documents recommend the BWR SCC Program, as well as the Water Chemistry Control Program to manage the aging effect for these AMR items. The staff noted that the systems, for which the BWR SCC Program was not credited, included the RHR, HPCI, and RCIC systems of the ESFs. In addition, the staff found that in the LRA the AMR items of the CS system did not include any piping, piping components, or piping elements subject to the SCC that would be managed by the BWR SCC Program.

Therefore, the staff issued RAI B.1.7-3 (for the components of the ESFs) and RAI B.1.7-2 (for the CS system), by letter dated May 1, 2009, requesting the applicant to clarify the foregoing issues. The applicant responded to RAI B.1.7-3 by letter dated June 15, 2009. In its response, the applicant stated that for systems that operate intermittently, the license renewal aging management review process conservatively selects the limiting environment for determination of aging effects. The applicant also stated that for example, portions of the residual heat removal system (RHR) system, which is in standby at ambient temperature during normal operation, will be exposed to temperatures greater than 140 °F when the system operates during shutdowns; so treated water greater than 140 °F is the environment selected. The applicant further stated that parts of the HPCI and RCIC systems, which are also in standby and only operate during testing, are similarly evaluated assuming a treated water environment greater than 140 °F.

In its response, the applicant stated that in NUREG-1801, the BWR SCC Program includes all BWR austenitic stainless steel piping that is 4 inches or larger in nominal diameter and that contains reactor coolant at a temperature above 200 °F during power operation regardless of ASME Code classification. The applicant also stated that since most of the RHR, HPCI, and RCIC components are normally in standby at ambient temperatures (less than 200 °F) during power operation, they are not included in the program. The applicant further stated that the portions of the EFS and auxiliary systems exposed to reactor coolant at temperatures greater than 200 °F during power operation are Class 1 components evaluated as part of the RCPB. The applicant stated that the AMR results for these components appear in Table 3.1.2-3.

In addition, the applicant stated that the Water Chemistry Control – BWR Program, along with One-Time Inspection Program to verify the Water Chemistry Control Program effectiveness, manages stress corrosion for these ESFs and auxiliary system components and this is consistent with other NUREG-1801 items (e.g., VIII.E-31).

As described above, the applicant clarified that the ESFs have no non-Class 1 components subject to the scope of the BWR SCC Program and GL 88-01. The applicant also clarified that the Water Chemistry Control – BWR Program, along with the One-Time Inspection Program to verify the Water Chemistry Control Program effectiveness, manages SCC for the non-Class 1 components of the ESFs. The applicant also responded to RAI B.1.7-2, by letter dated June 15, 2009, and the applicant stated that LRA Section 2.3.2.2 describes the CS system and as stated within the section, Class 1 components of the system are reviewed as part of the RCPB (LRA Section 2.3.1.3). The applicant also stated that the portions of the CS system exposed to temperatures greater than 140 °F are within the Class 1 RCPB and aging management results for these components appear in Table 3.1.2-3.

The applicant further stated that LRA Tables 3.2.2-2 and 3.2.2-8-2 present the AMR results for non-Class 1 CS system components and the components in this portion of the system are not exposed to temperatures greater than 140 °F. In addition, the applicant stated that these components are not subject to SCC.

In its response to RAI B.1.7-2, the applicant clarified that the portions of the CS system exposed to temperatures greater than 140 °F are within the Class 1 RCPB and aging management results for these components appear in Table 3.1.2-3. In addition, the applicant clarified that the non-Class 1 components in the CS system are not exposed to temperatures greater than 140 °F so the components are not subject to SCC. Therefore, the RAI response resolved the concern indicated in RAI B.1.7-2 regarding the aging management of SCC for non-Class 1 components of the CS system.

In relation with the aging management of the SCC in the ESF, the staff also reviewed the Water Chemistry Control – BWR Program and One-Time Inspection Program of the LRA. The review results of the AMPs are documented in SER Section 3.0.3. In its review, the staff finds the Water Chemistry Control Program is capable of mitigating the aging effect of cracking that can be caused by SCC. The staff also finds that this program controls water chemistry to minimize the environmental degradation of the components by maintaining the relevant water chemistry and limiting the levels of contaminants such as chloride and sulfate in the components of the ESF that may cause cracking. The staff finds that the One-Time Inspection Program, which performs inspections of selected components, including the areas of low or stagnant flow, is capable of detecting cracking due to SCC, if it should occur in the selected components. The staff also finds that the One-Time Inspection Program is adequate to verify whether the aging effect of cracking is progressing very slowly or not occurring in the components so that the intended functions of the components are maintained during the extended period of operation.

On the basis of its review, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 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

In LRA Section 3.2.2.2, the applicant further evaluates aging management, as recommended by the GALL Report, for the ESF components and provides information concerning how it will manage the following aging effects:

- loss of material due to cladding (breach) (PWR, not applicable)
- 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 (PWR, not applicable)
- loss of material due to general corrosion and fouling
- loss of material due to general, pitting, and crevice corrosion
- loss of material due to general, pitting, crevice, and MIC
- QA for aging management of nonsafety-related components

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which the report recommends further evaluation, the staff reviewed the applicant's evaluation to determine if it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.2.2.2. The staff's review of the applicant's further evaluation is discussed in the following sections.

3.2.2.2.1 Cumulative Fatigue Damage

LRA Section 3.2.2.2.1 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). SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

3.2.2.2.2 Loss of Material Due to Cladding Breach – PWR only, not applicable

3.2.2.2.3 Loss of Material Due to Pitting and Crevice Corrosion

LRA Section 3.2.2.2.3, item 1 addresses loss of material due to pitting and crevice corrosion for internal surfaces of stainless steel piping and components in containment isolation components exposed to treated water. The applicant indicated that it will manage this aging through the use of its Water Chemistry Control – BWR Program (B.1.29) as evaluated in SER Section 3.0.3. The applicant also indicated that the effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program (B.1.39) as evaluated in SER Section 3.0.3, through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow.

The staff reviewed LRA Section 3.2.2.2.3, item 1 against the criteria in SRP-LR Section 3.2.2.2.3, item 1, which indicates that loss of material due to pitting and crevice corrosion could occur for internal surfaces of stainless steel containment isolation piping, piping components, and piping elements exposed to treated water. The GALL Report indicates that the existing AMP (Water Chemistry (XI.M2)) relies on monitoring and control of water chemistry to mitigate degradation. The GALL Report also indicates that control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations of stagnant flow conditions. The GALL Report further indicates that the effectiveness of the Water Chemistry Control Program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of the Water Chemistry Control Program. A one-time inspection (GALL AMP XI.M32) of select components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

The staff notes that in LRA Section. 3.2.2.2.3, item 1, the applicant has identified appropriate AMPs and has identified the critical conditions requiring further review for the AMP to be in the stagnant areas (i.e., the potential for water chemistry control). The staff finds that LRA Section 3.2.2.2.3, item 1 is consistent with SRP-LR Section 3.2.2.2.3, item 1.

The staff also reviewed AMR items subordinate to LRA Table 3.2.1, item 3.2.1-31. This item refers to SRP-LR and LRA Sections 3.2.2.2.3, item 1. The staff noted that the applicant proposes that these AMR items are fully consistent with the GALL Report. Following its review of these items, the staff concurs with the applicant's assessment that these items are consistent with the GALL Report. As described in SRP-LR Section 3.01, LRA items which are determined to be consistent with the GALL Report are acceptable for license renewal.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.3, item 1 criteria. For those line items that apply to LRA Section 3.2.2.2.3, item 1, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3)

LRA Section 3.2.2.2.3, item 2 addresses loss of material from pitting and crevice corrosion for stainless steel piping and piping components exposed to a soil environment. The applicant indicated that it will manage this aging through the use of its Buried Piping and Tanks Inspection Program (LRA B.1.3) as evaluated in SER Section 3.0.3. The applicant also indicated that the Buried Piping and Tanks Inspection 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, gray cast iron, and stainless steel components. The applicant further indicated that buried components will be inspected when excavated during routine maintenance. The applicant finally indicated that an inspection will be performed within 10 years of entering the period of extended operation, unless an opportunistic inspection occurred within this 10-year period.

The staff reviewed LRA Section 3.2.2.2.3, item 2 against the criteria in SRP-LR Section 3.2.2.2.3, item 2, which indicates that loss of material from pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements exposed to soil. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed. The GALL Report indicates that acceptance criteria are described in BTP RSLB-1 (Appendix A.1 of the SRP-LR).

In its review of LRA Section 3.2.2.2.3, item 2, the staff also reviewed items subordinate to LRA Table 3.2.1, item 3.2.1-4, which is associated with this LRA section. In its review, the staff noted that the LRA AMP includes stainless steel while the Buried Piping and Tanks Inspection Program contained in the GALL Report does not. The staff also determined that the corrosion characteristics of stainless steel are sufficiently different from carbon steel so that some of the recommendations contained in the recommended AMP could be counterproductive for stainless steel. The staff further noted that during its AMP audit, the applicant indicated that the LRA was in error and that no buried stainless steel piping is present at CNS.

By letter dated May 1, 2009, the staff issued RAI B.1.3-1, which is related to the Buried Piping and Tanks Inspection Program requesting that the applicant clarify the existence of buried stainless steel piping and, if buried stainless steel piping is present, propose an AMP which will adequately address pitting and crevice corrosion of stainless steel pipe in contact with soil.

In its response dated June 15, 2009, the applicant stated that no buried stainless steel was present at the plant. The applicant revised appropriate sections of the LRA, including the Buried Piping and Tanks Inspection Program, to reflect that buried stainless steel was not present. The staff finds the applicant's currently proposed AMP acceptable because the AMP and AMR items are now consistent with the GALL Report AMP as defined in SRP-LR Section 3.2.2.2.3, item 2.

In its review of LRA Section 3.2.2.2.3, item 2, the staff also reviewed items subordinate to LRA Table 3.2.1, item 3.2.1-7 which is associated with this LRA section. In its review, the staff noted that answers to staff inquiries during the AMP audit indicated no buried stainless steel tanks were present. The staff also noted that a search of the applicant's USAR for "stainless steel tanks" failed to find any evidence that such tanks existed.

The staff concludes that the components addressed by this AMR item do not exist and that this item is not applicable.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.3, item 2 criteria. For those line items that apply to LRA Section 3.2.2.2.3, item 2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3)

<u>LRA Section 3.2.2.2.3, item 3</u> addresses loss of material from pitting and crevice corrosion for BWR stainless steel piping and piping components exposed to treated water. The applicant indicated that it will manage this aging through the use of its Water Chemistry Control – BWR Program (B.1.29) as evaluated in SER Section 3.0.3. The applicant also indicated that there are no aluminum components exposed to treated water in the ESF systems. The applicant further indicated that the effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program (B.1.39) as evaluated in SER Section 3.0.3 through an inspection of a representative sample of components crediting this program, including susceptible locations such as areas of stagnant flow.

The staff reviewed LRA Section 3.2.2.2.3, item 3 against the criteria in SRP-LR Section 3.2.2.2.3, item 3, which indicates that loss of material from pitting and crevice corrosion could occur for BWR stainless steel and aluminum piping, piping components, and piping elements exposed to treated water. The GALL Report states that the existing AMP (Water Chemistry (XI.M2)) relies on monitoring and control of water chemistry for BWRs to mitigate degradation. The GALL Report also indicates that control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations of stagnant flow conditions. The GALL Report further indicates that the effectiveness of the Water Chemistry Control Program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of the Water Chemistry Control Program. A one-time inspection (GALL AMP XI.M32) of selected components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

The staff notes that in LRA Section. 3.2.2.2.3, item 3, the applicant has identified appropriate AMPs and has identified the critical conditions requiring further review (i.e., the potential for water chemistry control to be ineffective in stagnant areas). The staff finds that LRA Section 3.2.2.2.3, item 3 is consistent with SRP-LR Section 3.2.2.2.3, item 3.

The staff also reviewed AMR items subordinate to LRA Table 3.2.1, item 3.2.1-5. This item refers to SRP-LR and LRA Sections 3.2.2.2.3, item 3. The staff noted that the applicant proposes that these AMR items are fully consistent with the GALL Report. Following its review of these items, the staff concurs with the applicant's assessment that these items are consistent with the GALL Report. As described in SRP-LR Section 3.01, items which are consistent with the GALL Report are acceptable for license renewal.

In its review, the staff noted that there were no AMRs items for which the material listed was aluminum. The staff also noted that a search of ESF section of the applications USAR for "aluminum" failed to demonstrate that any aluminum piping existed in this system. The staff concludes that aluminum piping does not exist in the ESF system.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.3, item 3 criteria. For those line items that apply to LRA Section 3.2.2.2.3, item 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 functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3)

<u>LRA Section 3.2.2.2.3, item 4</u> addresses loss of material due to pitting and crevice corrosion in piping, piping components, and piping elements exposed to lubricating oil in the ESF system. The applicant indicated that loss of material for stainless steel and copper alloy piping components exposed to lubricating oil is managed by the Oil Analysis Program. The Oil Analysis Program manages aging effects through periodic monitoring and control of contaminants, thus preserving an environment that is not conducive to corrosion. The applicant further indicated that the One-Time Inspection Program will provide a verification of the effectiveness of the Oil Analysis Program to manage loss of material due to crevice and pitting corrosion through examination of stainless steel and copper alloy components.

SRP-LR Section 3.2.2.2.3, item 4 indicates that loss of material due to pitting and crevice corrosion may occur in stainless steel and copper alloy piping, piping components, and piping elements exposed to lubricating oil. The LRA existing program periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always 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 programs. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the applicant's Oil Analysis Program and One-Time Inspection Program and its evaluations are documented in SER Section 3.0.3. The staff determined that the Oil Analysis Program includes periodic sampling and analysis of lubricating oil to determine if contaminants, particulates and water are present. The staff noted that the presence of these impurities in the lubricating oil can create an environment that is conducive to age-related degradation, such as loss of material, cracking, and fouling. The staff determined that the activities performed as part of this program will be capable of preserving an environment that will not promote loss of material, cracking, and fouling. The staff finds that these activities are consistent with the recommendations in the GALL Report and are adequate to manage loss of material due to pitting and crevice corrosion in copper alloy and stainless steel piping, piping components, and piping elements exposed to lubricating oil. The staff verified that the applicant has credited its One-Time Inspection Program, which includes a one-time inspection of selected components at susceptible locations, to verify the effectiveness of the Oil Analysis Program to manage this aging effect in the ESF system. On the basis that the applicant's AMPs are consistent with those recommended in SRP-LR Section 3.2.2.2.3, item 4, the staff finds the applicant's use of the Oil Analysis Program and One-Time Inspection Program acceptable.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.3, item 4 criteria. For those line items that apply to LRA Section 3.3.2.2.3, item 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, in accordance with 10 CFR 54.21(a)(3).

LRA Section 3.2.2.2.3, item 5 addresses loss of material from pitting and crevice corrosion which could occur for partially encased stainless steel tanks exposed to raw water due to cracking of the perimeter seal from weathering. The applicant indicated that at CNS, there are no outdoor stainless steel tanks in the ESF systems. The applicant also stated that this item was not used. The staff also noted that a search of the applicant USAR for "stainless steel tanks" failed to find any evidence that such tanks existed.

The staff reviewed LRA Section 3.2.2.2.3, item 5 against the criteria in SRP-LR Section 3.2.2.2.3, item 5, which indicates that loss of material from pitting and crevice corrosion could occur for partially encased stainless steel tanks exposed to raw water due to cracking of the perimeter seal from weathering. The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed. The GALL Report recommends that a plant-specific AMP be evaluated because moisture and water can egress under the tank if the perimeter seal is degraded. The GALL Report states that acceptance criteria are described in BTP RSLB-1 (Appendix A.1 of this SRP-LR).

The staff concludes that the components addressed by this AMR item do not exist at CNS and that this item is not applicable.

LRA Section 3.2.2.2.3, item 6 addresses loss of material from pitting and crevice corrosion for ESF stainless steel components internally exposed to condensation. The applicant indicated that it will manage this aging effect through the use of its PSPM Program (LRA B.1.31) as evaluated in SER Section 3.0.3. This program will periodically conduct a visual inspection of a representative sample of component internal surfaces to assure no unacceptable loss of material is occurring.

The staff reviewed LRA Section 3.2.2.2.3, item 6 against the criteria in SRP-LR Section 3.2.2.2.3, item 6, which indicates that loss of material from pitting and crevice corrosion could occur for stainless steel piping, piping components, piping elements, and tanks exposed to internal condensation. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed. The GALL Report indicates that acceptance criteria are described in BTP RSLB-1 (Appendix A.1 of the SRP-LR).

In its review of LRA Section 3.2.2.2.3, item 6, the staff also reviewed AMR items subordinate to LRA Table 3.2.1, item 3.2.1-8, which are associated with LRA Section 3.2.2.2.3, item 6. In this review, the staff noted that the applicant proposes that these items are consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited. The staff also noted that the aging effect being considered is loss of material from the internal surfaces of piping in the RCIC system. The staff further noted that in the table included in the proposed AMP, the applicant routinely indicates whether the inspections to be performed are internal or external. However, for piping inspections in the RCIC system, the applicant did not discuss whether the inspections to be conducted are internal, external, or both.

Therefore, by letter dated July 14, 2009, the staff issued RAI 3.2.2.2-1 requesting that the applicant specify in the proposed AMP if the inspections to be conducted of piping in the RCIC system are internal, external, or both.

In its response dated August 13, 2009, the applicant stated that the only item under consideration is a valve body exposed to an internal environment of condensation and that internal inspections would be conducted. The staff finds the applicant's currently proposed AMP acceptable because the applicant has indicated that an internal inspection is required and the proposed program is capable of identifying the aging effect under consideration on internal surfaces.

In LRA Table 3.3.2-5, for the RCIC system, the applicant addressed the valve body of stainless steel that is subject to cracking in a condensation (internal) environment. The applicant also indicated that the consistency note for the AMR item is LRA Note H, which means that aging effect is not addressed in the GALL Report for the component, material, and environment combination. The applicant indicated that the PSPM Program (LRA Section B.1.31) is credited for managing the cracking in the stainless steel component exposed to the condensation environment.

As the applicant indicated, the staff found that the GALL Report does not address cracking in stainless steel components in a condensation (internal) environment. As a comparison with the cracking of the AMR item, the staff noted that GALL Report, Volume 2, Table V.D2, item V.D2-32 addressed an item of loss of material in piping, piping components, and piping elements of stainless steel exposed to a condensation (internal) environment in the ESFs. The staff noted that the GALL Report recommends using a plant-specific program to manage the aging effect of loss of material for the AMR item.

The staff reviewed the PSPM Program and the review results of the AMP are documented in SER Section 3.0.3. The staff finds that the PSPM Program is an existing plant-specific program that includes periodic inspections of the components in the program scope to detect and manage loss of material and cracking. The staff also finds that this program assures the effects of aging are managed through relevant monitoring, maintenance, and corrective actions so that applicable components will continue to perform their intended functions. Therefore, the staff finds that the PSPM Program is adequate to manage the aging effect in the reactor core isolation system.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.3, item 6 criteria. For those line items that apply to LRA Section 3.2.2.2.3, item 6, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.2.2.2.4 Reduction of Heat Transfer Due to Fouling

LRA Section 3.2.2.2.4, item 1 addresses reduction of heat transfer due to fouling for copper alloy heat exchanger tubes exposed to lubricating oil in ESF systems. The applicant indicated that this aging effect is managed by the Oil Analysis Program, which maintains contaminant levels within acceptable limits, thereby preserving an environment that is not conducive to fouling. The applicant further indicated that the One-Time Inspection Program will confirm that the Oil Analysis Program has been effective at managing the loss of heat transfer due to fouling by using visual inspections or NDEs of representative samples of components crediting this program. The applicant noted that there are no steel or stainless steel heat exchanger tubes exposed to lubricating oil in ESF systems.

SRP-LR Section 3.2.2.2.4, item 1 indicates that loss of heat transfer due to fouling could occur for steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil. The existing AMP relies on monitoring and controlling lube oil chemistry to mitigate reduction of heat transfer due to fouling. 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 programs and notes that a one-time inspection of selected components at susceptible locations is an acceptable method for determining that this aging effect is not occurring.

The staff evaluated the applicant's Oil Analysis and One-Time Inspection programs in SER Sections 3.0.3 and determined that both programs were acceptable. The staff noted that the Oil Analysis Program includes periodic sampling and analysis of lubricating oil to determine if contaminants, particulates, and water are present. The staff noted that the presence of these impurities in the lubricating oil can create an environment that is conducive to age-related degradation including fouling. The staff determined that the activities performed as part of this program will be capable of preserving an environment that will not promote fouling. The staff finds that these activities are consistent with the recommendations in the GALL Report, and are adequate to manage loss of heat transfer in copper alloy heat exchanger tubes exposed to lubricating oil. The staff confirmed that the applicant will use its One-Time Inspection Program to verify the effectiveness of the Oil Analysis Program, which will include a one-time inspection of selected components at susceptible locations, to manage this aging effect in ESF systems. The staff finds the applicant's use of the Oil Analysis and One-Time Inspection Programs are acceptable to manage the reduction of heat transfer due to fouling, because these AMPs are the recommended programs in SRP-LR Section 3.2.2.2.4, item 1.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.4, item 1 criteria. For those line items that apply to LRA Section 3.2.2.2.4, item 1, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

LRA Section 3.2.2.2.4, item 2 addresses reduction of heat transfer due to fouling for stainless steel heat exchanger tubes exposed to treated water in ESF systems. The applicant indicated that this aging effect is managed by the Water Chemistry Control – BWR Program. The applicant further indicated that the One-Time Inspection Program will confirm the effectiveness of the Water Chemistry Control – BWR Program by visually inspecting a representative sample of components crediting this program, including susceptible locations such as areas of stagnant flow.

SRP-LR Section 3.2.2.2.4, item 2 indicates that reduction of heat transfer due to fouling may occur for stainless steel heat exchanger tubes exposed to treated water, and that management of this aging effect relies on water chemistry control. However, since control of water chemistry may have been inadequate, the GALL Report recommends that the effectiveness of the Water Chemistry Control Program be verified to ensure that heat transfer reduction due to fouling is not occurring. A one-time inspection is noted as an acceptable method to ensure that reduction of heat transfer is not occurring and that components' intended functions will be maintained during the period of extended operation. The staff noted the discussion in GALL AMP XI.M2, "Water Chemistry," relative to water chemistry programs being generally effective in removing impurities, except in low flow or stagnant flow areas.

The staff evaluated the applicant's Water Chemistry Control – BWR Program and One-Time Inspection Program in SER Sections 3.0.3 and determined that both programs were acceptable. The staff determined that the Water Chemistry Control – BWR Program was consistent with the program elements of GALL AMP XI.M2 and noted that the program relies on monitoring and controlling water chemistry based on EPRI Report 1008192. The staff considers that the activities performed as part of this program will be capable of preserving an environment that does not promote fouling. The staff also verified that the applicant will use its One-Time Inspection Program to verify the effectiveness of the Water Chemistry Control – BWR Program, which will include a one-time inspection of selected components at susceptible locations, to ensure no significant fouling is occurring in ESF systems. The staff finds the applicant's use of the Water Chemistry Control - BWR Program, combined with the One-Time Inspection Program, is acceptable to manage the reduction of heat transfer due to fouling, because these AMPs are the recommended programs in SRP-LR Section 3.2.2.2.4, item 2.

Based on the programs identified above, the staff concludes that the applicant's programs meet the criteria of SRP-LR Section 3.2 2.2.4, item 2. For those line items that apply to LRA Section 3.2.2.2.4, item 2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 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, which indicates that hardening and loss of strength due to elastomer degradation may occur in elastomeric seals and components associated with auxiliary HV systems that are exposed either internally or externally to uncontrolled indoor air. The SRP-LR recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

The staff reviewed Section B.1.31 of the LRA and finds that the applicant's PSPM Program is adequate to detect hardening and loss of strength of elastomeric components. The staff finds that physical manipulations of the flexible connections will confirm that components have not experienced any aging/cracking that would affect their intended function.

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, in accordance with 10 CFR 54.21 (a)(3).

3.2.2.2.6 Loss of Material Due to Erosion – For PWR only, not applicable for CNS

3.2.2.2.7 Loss of Material Due to General Corrosion and Fouling

LRA Section 3.2.2.2.7 addresses loss of material due to general corrosion and fouling occurring for steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to indoor air. The applicant indicated that at CNS, the spray nozzles are copper alloy and are not subject to loss of material due to general corrosion in an indoor air environment. The applicant also indicated that there are no steel orifices in drywell and suppression chamber spray systems which are internally exposed to an indoor air environment.

The staff reviewed LRA Section 3.2.2.2.7 against the criteria in SRP-LR Section 3.2.2.2.7, which indicates 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. The GALL Report indicates that this could result in plugging of the spray nozzles and flow orifices. The GALL Report also indicates that 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 GALL Report further indicates that 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 GALL Report indicates that acceptance criteria are described in BTP RSLB-1 (Appendix A.1 of this SRP-LR).

In reviewing LRA Section 3.2.2.2.7, the staff also reviewed items subordinate to LRA Table 3.2.1, item 13, which are related to LRA Section 3.2.2.2.7. In this review, the staff noted that a search of the applicant's USAR for "steel nozzles" failed to find any evidence that such nozzles existed. The staff also checked the GALL Report and found that no aging effects are attributed to copper alloys exposed to uncontrolled indoor air.

The staff concludes that the components addressed by this AMR item do not exist and that this item is not applicable. The staff also concludes that aging management is not required for the copper nozzles which are present.

3.2.2.2.8 Loss of Material Due to General, Pitting, and Crevice Corrosion

<u>LRA Section 3.2.2.2.8, item 1</u> addresses loss of material due to general, pitting, and crevice corrosion for BWR steel piping and components in ESF systems exposed to treated water. The applicant indicated that it will manage this aging through the use of its Water Chemistry Control – BWR Program (B.1.29) as evaluated in SER Section 3.0.3. The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program (B.1.39) (evaluated in SER Section 3.0.3) through an inspection of a representative sample of components crediting this program including susceptible locations such as areas of stagnant flow. The applicant indicated that the PSPM Program (B.1.31) (evaluated in SER Section 3.0.3) will be used to supplement the Water Chemistry Control – BWR Program for components at the waterline in the suppression chamber using periodic visual inspections or other NDE techniques.

The staff reviewed LRA Section 3.2.2.2.8, item 1 against the criteria in SRP-LR Section 3.2.2.2.8, item 1, which indicates that loss of material due to general, pitting, and crevice corrosion could occur for BWR steel piping, piping components, and piping elements exposed to treated water. The GALL Report indicates that the existing AMP (GALL AMP XI.M2, “Water Chemistry”) relies on monitoring and control of water chemistry for BWRs to mitigate degradation. The GALL Report also indicates that control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations of stagnant flow conditions. The GALL Report further indicates that the effectiveness of the Water Chemistry Control Program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of the Water Chemistry Control Program. A one-time inspection (GALL AMP XI.M32) of selected components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly such that the component’s intended function will be maintained during the period of extended operation.

The staff notes that in LRA Section. 3.2.2.2.8, item 1, the applicant has identified appropriate AMPs and has identified the critical conditions requiring further review (i.e., the potential for water chemistry control to be ineffective in stagnant areas). The staff finds that LRA Section 3.2.2.2.8, item 1 is consistent with SRP-LR Section 3.2.2.2.8, item 1.

The staff also reviewed AMR items subordinate to LRA Table 3.2.1, item 3.2.1-14, which is associated with LRA Section 3.2.2.2.8, item 1. In this review, the staff noted that the applicant proposes that the components associated with LRA item 3.2.1-14 are either fully consistent with the GALL Report, consistent with the GALL Report in all respects except the component is different, or consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited.

In its review of components subordinate to LRA item 3.2.1-14, for which the applicant assigned LRA Note A, the staff concurs with the applicant that these items are, in fact, consistent with the GALL Report. As described in SRP-LR Section 3.01, items which are consistent with the GALL Report are acceptable for license renewal.

In its review of components subordinate to LRA item 3.2.1-14, for which the applicant assigned LRA Note C, the staff noted that the components listed do not meet the precise definition of the GALL Report. However, the staff also noted that the corrosion mechanisms and rates expected in these components are similar to those expected for the components listed in the GALL Report and that the same AMP could be effectively employed. The staff accepts that the components under consideration are sufficiently similar to those actually included in SRP-LR 3.2.1, item 14, not to render them inconsistent with the GALL Report. As described in SRP-LR Section 3.01, items which are consistent with the GALL Report are acceptable for license renewal.

In its review of components subordinate to LRA item 3.2.1-14, for which the applicant assigned LRA Note E, the staff noted that the components under consideration are the external surfaces of components at the waterline of the suppression pool. The staff also noted that the applicant has, elsewhere in the application, classified the suppression pool as treated water subject to chemistry control as required by the Water Chemistry Program. The staff further notes that the PSPM Program is designed to detect loss of material on external surfaces. Based on the above, the staff believes that the proposed AMP will be at least as effective as that proposed by the GALL Report as the water chemistry will be controlled and the components will be periodically inspected (as opposed to a one-time inspection as recommended by the GALL Report).

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.8, item 1 criteria. For those line items that apply to LRA Section 3.2.2.2.8, item 1, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3)

LRA Section 3.2.2.2.8, item 2 addresses loss of material due to general, pitting, and crevice corrosion for PC penetration steel piping and components exposed to treated water. The applicant indicated that it will manage this aging through the use of its Water Chemistry Control – BWR Program (B.1.29) (evaluated in SER Section 3.0.3). The applicant also indicated that the effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program (B.1.39) (evaluated in SER Section 3.0.3) through an inspection of a representative sample of components crediting this program, including susceptible locations such as areas of stagnant flow.

The staff reviewed LRA Section 3.2.2.2.8, item 2 against the criteria in SRP-LR Section 3.2.2.2.8, item 2, which indicates that loss of material due to general, pitting, and crevice corrosion could occur for the internal surfaces of steel containment isolation piping, piping components, and piping elements exposed to treated water. The GALL Report indicates that the existing AMP (GALL AMP XI.M2, "Water Chemistry") relies on monitoring and control of water chemistry to mitigate degradation. The GALL Report also indicates that control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations of stagnant flow conditions. The GALL Report further indicates that the effectiveness of the Water Chemistry Control Program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of the Water Chemistry Control Program. A one-time inspection (GALL AMP XI.M32) of selected components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

The staff notes that in LRA Section. 3.2.2.2.8, item 2, the applicant has identified appropriate AMPs and has identified the critical conditions requiring further review (i.e., the potential for water chemistry control to be ineffective in stagnant areas). The staff finds that LRA Section 3.2.2.2.8, item 2 is consistent with SRP-LR Section 3.2.2.2.8, item 2.

The staff also reviewed AMR items subordinate to LRA Table 3.2.1, item 3.2.1-15. This item refers to SRP-LR and LRA Sections 3.2.2.2.8, item 2. The staff noted that the applicant proposes that these AMR items are fully consistent with the GALL Report (LRA Note A). Following its review of these items, the staff concurs with the applicant's assessment that these items are consistent with the GALL Report. As described in SRP-LR Section 3.01, items which are consistent with the GALL Report are acceptable for license renewal.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.8, item 2 criteria. For those line items that apply to LRA Section 3.2.2.2.8, item 2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

LRA Section 3.2.2.2.8, item 3 addresses loss of material due to general, pitting, and crevice corrosion in piping, piping components, and piping elements exposed to lubricating oil in the

ESF system. The applicant indicated that loss of material for steel and cast iron piping components exposed to lubricating oil is managed by the Oil Analysis Program. The Oil Analysis Program manages aging effects through periodic monitoring and control of contaminants, thus preserving an environment that is not conducive to corrosion. The applicant further indicated that the One-Time Inspection Program will provide a verification of the effectiveness of the Oil Analysis Program to manage loss of material due to general, crevice, and pitting corrosion through examination of steel and cast iron components.

SRP-LR Section 3.2.2.2.8, item 3 indicates 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 periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always 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 programs. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the applicant's Oil Analysis Program and One-Time Inspection Program and its evaluations are documented in SER Section 3.0.3. The staff determined that the Oil Analysis Program includes periodic sampling and analysis of lubricating oil to determine if contaminants, particulates, and water are present. The staff determined that the presence of these impurities in the lubricating oil can create an environment that is conducive to age-related degradation, such as loss of material, cracking, and fouling. The staff determined that the activities performed as part of this program will be capable of preserving an environment that will not promote loss of material, cracking, and fouling. The staff finds that these activities are consistent with the recommendations in the GALL Report and are adequate to manage loss of material due to general, pitting, and crevice corrosion in steel piping, piping components, and piping elements exposed to lubricating oil. The staff verified that the applicant has credited its One-Time Inspection Program, which includes a one-time inspection of selected components at susceptible locations, to verify the effectiveness of the Oil Analysis Program to manage this aging effect in the ESF system. On the basis that the applicant's AMPs are consistent with those recommended in SRP-LR Section 3.2.2.2.8, item 3, the staff finds the applicant's use of the Oil Analysis Program and One-Time Inspection Program acceptable.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.8, item 3 criteria. For those line items that apply to LRA Section 3.2.2.2.8, item 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 functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.2.2.2.9 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

LRA Section 3.2.2.2.9 addresses loss of material due to general, pitting, crevice, and MIC for steel piping (with or without coating or wrapping) buried in soil. The applicant indicated that it will manage this aging effect through the use of its Buried Piping and Tanks Inspection Program (evaluated in SER Section 3.0.3). The applicant also indicated that the Buried Piping and Tanks Inspection 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. The applicant further indicated that the buried components will be inspected when excavated during maintenance. The applicant finally indicated that an inspection will be performed within 10 years of entering the period of extended operation, unless an opportunistic inspection occurred within this 10-year period.

The staff reviewed LRA Section 3.2.2.2.9 against the criteria in SRP-LR Section 3.2.2.2.9, which indicates that loss of material due to general, pitting, crevice, and MIC could occur for steel piping (with or without coating or wrapping), piping components, and piping elements buried in soil. The GALL Report indicates that the Buried Piping and Tanks Inspection Program relies on industry practice, frequency of pipe excavation, and OE to manage the effects of loss of material from general, pitting, and crevice corrosion and MIC. The GALL Report also indicates that the effectiveness of the Buried Piping and Tanks Inspection Program should be verified to evaluate an applicant's inspection frequency and OE with buried components, ensuring that loss of material is not occurring.

The staff also reviewed AMR items subordinate to LRA Table 3.2.1, item 3.2.1-17, which is associated with LRA Section 3.2.2.2.9. In this review, the staff noted that the applicant proposes that the components associated with LRA item 3.2.1-17 are either fully consistent with the GALL Report (LRA Note A) or are consistent with the GALL Report in all respects except the component is different (LRA Note C).

In its review of components subordinate to LRA item 3.2.1-17, for which the applicant assigned LRA Note A, the staff concurs with the applicant that these items are, in fact, consistent with the GALL Report. As described in SRP-LR Section 3.01, items which are consistent with the GALL Report are acceptable for license renewal.

In its review of components subordinate to LRA item 3.2.1-17, for which the applicant assigned LRA Note C, the staff noted that the components listed do not meet the precise definition of the GALL Report. However, the staff also noted that the corrosion mechanisms and rates expected in these components are similar to those expected for the components listed in the GALL Report and that the same AMP could be effectively employed. The staff accepts that the components under consideration are sufficiently similar to those actually included in SRP-LR Table 3.2.1, item 17, not to render them inconsistent with the GALL Report. As described in SRP-LR Section 3.01, items which are consistent with the GALL Report are acceptable for license renewal.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.9 criteria. 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 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, in accordance with 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

3.2.2.3 AMR Results That Are Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.2.2-1 through 3.2.2-7 and 3.2.2-8-1 through 3.2.2-8-6, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations that are not consistent with or not addressed 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 or not 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. The staff's evaluation is documented in the following sections.

3.2.2.3.1 Stainless Steel Exposed to Air-Indoor (Internal)

In LRA Tables 3.2.2-01, 3.2.2-03, 3.2.2-04, 3.2.2-06, and 3.2.2-07, the applicant indicated that piping, piping components, and piping elements fabricated from stainless steel material exposed to air-indoor (internal) does not have an aging effect, therefore an AMP is not required. The AMR line items cite LRA Note G, which indicates that the environment is not addressed in the GALL Report for this component and material combination.

During its review, the staff noted that the LRA did not provide a justification as to why stainless material exposed to air-indoor (internal) does not have an aging effect. Therefore, by letter dated June 29, 2009, the staff issued RAI 3.3-4 requesting the applicant describe the environmental conditions that exist in the internal environment of these components and to justify why these components are not subject to an aging effect requiring management when exposed to air-indoor (internal). In its response dated July 29, 2009, the applicant stated that for all stainless steel components described above the environmental conditions on the internal and external surface are identical. The applicant further indicated that the internal environment is consistent with the definition of air-indoor uncontrolled in GALL Report, Table IX.D. The applicant's response satisfied the staff's question regarding defining the internal environment.

The staff noted that the applicant defines the environment of air-indoor as "indoor air on systems with temperatures higher than the dew point" which is the same as the GALL Report definition for air-indoor uncontrolled, as defined in Table XI.D. The staff reviewed Section V.F of the GALL Report and noted that GALL Report, item V.F-12 indicates that piping, piping components, and piping elements fabricated of stainless steel that are exposed to air-indoor uncontrolled does not experience an aging effect requiring management. Therefore, the staff determined the applicant has appropriately identified that the stainless steel piping, piping components, and piping elements do not experience an aging effect requiring aging management because it is consistent with the recommendations of GALL Report, item V.F-12.

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 functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.2.2.3.2 Copper Alloy Exposed to Air-Indoor (Internal)

The applicant indicated in LRA Table 3.2.2-1 (RHR system), 3.2.2-6 (SGTS) and 3.2.2-7 (PC system) that piping, piping components, and piping elements fabricated from copper alloy greater than 15 percent zinc (Zn) or 8 percent aluminum (Al) and copper alloy material exposed to air-indoor (internal) do not have an aging effect, therefore an AMP is not required. The AMR line items cite LRA Note G, which indicates that the environment is not addressed in the GALL Report for this component and material combination.

During its review, the staff noted that the LRA did not provide a justification as to why copper alloy greater than 15 percent Zn or 8 percent Al and copper alloy material exposed to air-indoor (internal) do not have an aging effect. Therefore, by letter dated June 29, 2009, the staff issued RAI 3.3-4 requesting the applicant describe the environmental conditions that exist in the internal environment of these components and to justify why these components are not subject to an aging effect requiring management when exposed to air-indoor (internal). In its response dated July 29, 2009, the applicant stated that for copper alloy greater than 15 percent Zn or 8 percent Al and copper alloy components described above, the environmental conditions on the internal and external surface are identical. The applicant further indicated that the internal environment is consistent with the definition of air-indoor uncontrolled in GALL Report, Table IX.D. The staff finds the applicant's response acceptable because (1) the applicant clearly defined the internal environment as being identical with the external environment, therefore resolving the staff's concern that the internal environment may contain contaminants and stagnant conditions.

The staff noted that the applicant's definition for the environment of air-indoor as "indoor air on systems with temperatures higher than the dew point" is the same as the GALL Report definition for air-indoor uncontrolled in Table XI.D. The staff reviewed GALL Report, Section V.F and noted that GALL AMR item V.F-3 states that piping, piping components, and piping elements fabricated of copper alloy that are exposed to air-indoor uncontrolled do not experience an aging effect requiring management. Therefore, the staff determined the applicant has appropriately identified that the copper alloy piping, piping components and piping elements do not experience an aging effect requiring aging management because it is consistent with the recommendations of GALL Report, item V.F-3.

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 functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.2.2.3.3 Carbon Steel Bolting and Fasteners Exposed to Outdoor Air or Treated Water

In LRA Table 3.2.2-4, the applicant proposed to manage loss of preload due to thermal effects, gasket creep, and self loosening for carbon steel bolting, and fasteners externally exposed to outdoor air or treated water using the Bolting Integrity Program. The AMR line items cite plant-specific Note 206, which indicates that the environments stated in the LRA for these items are considered by the applicant to be equivalent to the NUREG-1801 defined environments of air with reactor coolant leakage or air-indoor uncontrolled for the evaluation of the loss of preload aging effect since loss of preload is not significantly dependent on environment.

The LRA credits the Bolting Integrity Program to manage this aging effect. The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3. The Bolting Integrity Program is an existing CNS program that will manage the loss of preload through periodic inspection and preventive measures. The staff noted that the mechanisms identified in the GALL Report as causing loss of preload in carbon steel bolts are thermal effects, gasket creep, and self-loosening, which are not all dependent on the bolting material or environment. The staff also noted that activities in the Bolting Integrity program that control and manage loss of preload are effective for various bolting materials. Additionally, the staff reviewed the Bolting Integrity Program to verify that loss of preload due to thermal effects, gasket creep, and self-loosening will be managed in accordance with the recommendations specified by the Bolting Integrity Program. On the basis of its review, the staff finds that because these components will be inspected through the specifications of the Bolting Integrity Program, they will be adequately managed.

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, in accordance with 10 CFR 54.21(a)(3).

3.2.2.3.4 No Aging Effect in the Rupture Disc in the Air-Indoor Environment (Internal)

In LRA Table 3.2.2-6, page 3.2-81, the applicant indicated that the nickel alloy rupture disk in the SGTS of the ESFs is exposed to an air-indoor environment on the internal surface of the rupture disk and the AMR item is not subject to aging effects. The applicant described that the consistency note for this item is LRA Note G, which means the environment is not included in the GALL Report for the component and material.

The staff reviewed the AMR item of the nickel alloy rupture disk in comparison with the GALL Report and found that the consistency LRA Note G was adequate as the GALL Report did not include an AMR item of the air-indoor environment for a nickel alloy internal surface. The staff also found that in the GALL Report, nickel alloy external surfaces are not subject to aging effects in an air-indoor environment. For example, GALL Report, Volume 2, Table V.F, item V.F-11, for the ESFs indicates that nickel alloy piping, piping components, and piping elements are not subject to aging effects in an air-indoor environment. Based on this technical information from the GALL Report, the staff finds that the aging effect of the air-indoor environment on nickel alloy internal surfaces is not significant enough to require aging management, either.

On the basis of its technical review in comparison with the GALL Report, the staff determines that the AMR item has no aging effect and the AMR results in the LRA are adequate and acceptable for the nickel alloy rupture disc exposed to the air-indoor environment.

3.2.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the ESF components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 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:

- standby liquid control system
- control rod drive hydraulic system
- service water system
- diesel generators
- fuel oil
- fire protection – water
- Halon and CO2
- heating, ventilation, and air conditioning
- fuel pool cooling and cleanup

- instrument air
- reactor equipment and cooling
- plant drains
- nitrogen
- miscellaneous auxiliary systems within the scope of license renewal in accordance with 10 CFR 54.4(a)(2)

3.3.1 Summary of Technical Information in the Application

LRA Section 3.3.2 provides AMR results for the auxiliary systems components and component groups. LRA Tables 3.3.2-1 through 3.3.2-13 provide summary comparison of the applicant’s AMRs with those evaluated in the GALL Report for the auxiliary systems components and component groups. LRA Tables 3.3.2-14-1 through 3.3.2-14-29 provide summary comparison of the applicant’s AMRs with those evaluated in the GALL Report for the miscellaneous auxiliary systems components and component groups within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).

The applicant’s AMRs evaluated and incorporated applicable plant-specific and industry OE 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 OE included a review of the GALL Report and OE issues identified since the issuance of the GALL Report.

3.3.2 Staff Evaluation

The staff reviewed LRA Section 3.3 to determine whether or not the applicant provided sufficient information to demonstrate that the effects of aging for the auxiliary systems components within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

The staff reviewed AMRs to ensure the applicant’s claim that certain AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did confirm that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff’s evaluations of the AMPs are documented in SER Section 3.0.3. Details of the staff’s evaluation are documented in SER Section 3.3.2.1.

The staff also reviewed AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant’s further evaluations were consistent with the SRP-LR Section 3.3.2.2 acceptance criteria. The staff’s evaluations are documented in SER Section 3.3.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with or not addressed in the GALL Report. The technical review evaluated whether or not all plausible aging effects have been identified and whether or not the aging effects listed were appropriate for the material-environment combinations specified. The staff’s evaluations are documented in SER Section 3.3.2.3.

For SSCs which the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR line items and the plant’s OE to verify the applicant’s claims.

In summary, the staff's review of the auxiliary systems component groups followed any one of several approaches. One approach, documented in SER Section 3.3.2.1, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.3.2.2, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.3.2.3, reviewed AMR results for components that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the auxiliary systems components is documented in SER Section 3.0.3.

3.3.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.3.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the auxiliary systems components:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- Oil Analysis Program
- Periodic Surveillance and Preventive Maintenance (PSPM) Program
- Water Chemistry Control – BWR Program
- Buried Piping and Tanks Inspection Program
- Selective Leaching Program
- Service Water Integrity Program
- Water Chemistry Control – Closed Cooling Water (CCW) Program
- Diesel Fuel Monitoring Program
- Fire Protection Program
- Aboveground Steel Tanks Program
- Fire Water System Program
- Neutron Absorber Monitoring Program
- Flow-Accelerated Corrosion Program
- One-Time Inspection Program
- Water Chemistry Control – Auxiliary Systems Program

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 review determined whether or not the plant-specific components of these GALL Report component groups were bounded by the GALL Report evaluation.

The staff reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the ESF components that are subject to an AMR. On the basis of its review, the staff determines that, for AMRs not requiring further evaluation, as identified in LRA Table 3.3.1, the applicant's references to the GALL Report are acceptable and no further staff review is required, with the exception of the following AMRs that the applicant had identified were consistent with the AMRs of the GALL Report and for which the staff felt were in need of additional clarification and assessment. The staff's evaluations of these AMRs are provided in the following sections.

3.3.2.1.1 Loss of Material Due to General, Pitting, and Crevice Corrosion from the Steel Piping, Piping Components, Piping Elements, Tanks, and Heat Exchanger Components Exposed to Closed Cycle Cooling Water

LRA and SRP-LR Table 3.3.1, item 3.3.1-47 address the loss of material due to general, pitting, and crevice corrosion from the steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to closed cycle cooling water. The SRP-LR defines the environment as "closed cycle cooling water." The LRA defines the environment as "treated water." The applicant proposes that "treated water" approximates "closed cycle cooling water" (LRA Note 306). The applicant proposes to manage this aging process through the use of its Water Chemistry Control – Auxiliary Systems Program (evaluated in SER Section 3.0.3). The GALL Report recommends that this aging process be managed through the use of GALL AMP XI.M21, "Closed Cycle Cooling Water System." The proposed AMP is not consistent with the AMP proposed by the GALL Report. As a result, the applicant proposes that the AMR items associated with item 3.3.1-47 are consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited.

In its review of LRA item 3.3.1-47, the staff noted that neither the target values for the water chemistry nor the industry standard upon which the target water chemistry values are based are provided. The staff also noted from the OE associated with the proposed AMP that water chemistry excursions are not rare events. The staff further noted that the proposed AMP calls for a one-time inspection to verify the effectiveness of the Water Chemistry Program. Lastly, the staff questions the effectiveness of a One-Time Inspection Program for the components being considered in light of the water chemistry excursions reported in the applicant's OE and the inclusion of periodic inspections in the AMP recommended by the GALL Report.

By letter dated June 29, 2009, the staff issued RAI 3.2.2.1-7 requesting that the applicant provide information concerning the target water chemistry values, the source of the industry guidelines used in determining the appropriate water chemistry for the system (it should be noted that water chemistry guidance provided by a manufacturer or a water treatment company do not constitute an industry standard), the critical characteristics of the system(s) being considered (e.g., boiler pressures), and justification regarding why a one-time inspection should be considered adequate to manage aging in light of the stated variability in the water chemistry.

In its response dated August 13, 2009, the applicant indicated that much of the information requested was provided in its response to RAI B.1.38-1 (evaluated with the Water Chemistry Control – Auxiliary Systems Program in SER Section 3.0.3). This was reviewed by the staff and found to be acceptable. The applicant also indicated that corrective actions have been implemented to improve the consistency of water chemistry control. The staff finds the applicant's currently proposed AMP acceptable because appropriate water chemistry guidelines are being utilized and actions to improve the consistency of water chemistry control have been implemented.

On the basis of its review, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.1.2 Loss of Material Due to General and Pitting Corrosion from the Internal Surfaces of Steel Piping, Piping Components, and Piping Elements Exposed to Condensation in the Compressed Air System

LRA and SRP-LR Table 3.3.1, item 3.3.1-53 address the loss of material due to general and pitting corrosion from the internal surfaces of steel piping, piping components, and piping elements exposed to condensation in the compressed air system. The applicant proposes to manage this aging process through the use of its PSPM Program (reviewed in SER Section 3.0.3). The GALL Report recommends that this aging process be managed through the use of GALL AMP XI.M24, “Compressed Air Monitoring.” The proposed AMP is not consistent with the AMP proposed by the GALL Report. As a result, the applicant proposes that the AMR item 3.3.1-53 is consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited.

In its review of LRA item 3.3.1-53, the staff noted that the proposed AMP includes the internal inspection of a single containment penetration associated with the compressed air system. The staff also noted that the AMP recommended by the GALL Report is much more comprehensive, including inspection, testing, and preventive maintenance. Given the difference in the programs, the staff questions the effectiveness of the proposed program.

By letter dated June 29, 2009, the staff issued RAI 3.3.2.1-1 requesting that the applicant select an AMP designed to detect general and pitting corrosion on the internal surfaces of piping, piping components, and piping elements exposed to condensation in the compressed air system, as well as a program which includes the testing and preventive maintenance components included in the AMP recommended by the GALL Report or justify how the proposed plan will accomplish those functions.

In its response dated July 29, 2009, the applicant stated that the components under consideration were normally isolated from the SA system, thereby eliminating the value of air quality testing, as recommended by the GALL AMP, as a mean for managing loss of material. The applicant also indicated that both the applicant’s program and the GALL Report recommended program contain visual inspection programs which are equally capable of detecting this aging effect. The staff finds the applicant’s currently proposed AMP acceptable because it contains appropriate inspection techniques and because the additional aspects of the program recommended by the GALL Report will not be effective in managing loss of material for this component.

On the basis of its review, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.1.3 Loss of Material Due to General Corrosion from the External Surfaces of Steel Components Exposed to Uncontrolled Indoor Air, Outdoor Air, and Condensation

LRA and SRP-LR Table 3.3.1, item 3.3.1-58 address the loss of material due to general corrosion from the external surfaces of steel components exposed to uncontrolled indoor air, outdoor air, and condensation. The applicant proposes to manage this aging process through the use of its Fire Protection Program (reviewed in SER Section 3.0.3). The GALL Report recommends that this aging process be managed through the use of GALL AMP XI.M36, “External Surfaces Monitoring.” The proposed AMP is not consistent with the AMP proposed by the GALL Report. As a result, the applicant proposes that the AMR item 3.3.1-58 is consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited.

In its review of LRA item 3.3.1-58, the staff noted that the aging effect being considered is the loss of material due to general corrosion on the external surface of steel components. The staff also noted that the scope of the proposed AMP does not include the detection of loss of material due to general corrosion.

By letter dated June 29, 2009, the staff issued RAI 3.2.2.1-6 requesting that the applicant select an AMP with a scope which includes detecting loss of material due to general corrosion on external steel surfaces exposed to uncontrolled indoor air, outdoor air, or condensation or justify how the currently proposed AMP will adequately address the corrosion associated with these components.

In its response dated July 29, 2009, the applicant pointed out that both the AMR line item under consideration and the proposed AMP do contain references to the conduct of visual inspections for the purpose of detecting loss of material. The staff finds the applicant's currently proposed AMP acceptable because it contains inspection techniques which are considered adequate to detect the aging effect under consideration.

On the basis of its review, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.1.4 Loss of Material Due to General, Pitting, and Crevice Corrosion from the Internal Surfaces of Steel Piping, Piping Components, and Piping Elements Exposed to Moist Air or Condensation

LRA and SRP-LR Table 3.3.1, item 3.3.1-71 address the loss of material due to general, pitting, and crevice corrosion from the internal surfaces of steel piping, piping components, and piping elements exposed to moist air or condensation. The applicant proposes to manage this aging process through the use of its PSPM Program (reviewed in SER Section 3.0.3). The GALL Report recommends that this aging process be managed through the use of the GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components." The proposed AMP is not consistent with the AMP proposed by the GALL Report. As a result, the applicant proposes that the AMR item 3.3.1-71 is consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited.

In its review of LRA item 3.3.1-71, the staff noted that the proposed and recommended AMPs appear to differ in how many components are inspected and the frequency of that inspection. The proposed program appears to indicate that a sample of sufficient size to provide 90 percent confidence that 90 percent of the components will not degrade will be inspected every five years. The recommended program indicates that all components will be inspected whenever the component is accessible. Based on the difference in the sample size outlined above, it is not clear to the staff that the same level of inspection is provided by the proposed AMP when compared with the AMP recommended by the GALL Report.

By letter dated June 29, 2009, the staff issued RAI 3.2.2.1-7 requesting that the applicant demonstrate that the level of inspection provided by the proposed AMP is equivalent to that provided by the recommended AMP.

In its response dated July 29, 2009, the applicant stated that the components under consideration include the internal surfaces of moisture separator housing, piping, receiver, and valve body components for the DG and the internal surfaces of piping and valve body components for the DGSA system. The applicant also indicated that statistical sampling may result in more inspections when carried out on a periodic basis (once in five years) than an exhaustive inspection of all components when available for other reasons. The staff finds the applicant's currently proposed AMP acceptable because the staff concurs with the applicant's assessment that the components in question will not be opened often and that a periodic inspection based on a random sample is likely to result in more inspections than an opportunistic inspection of all available components.

On the basis of its review, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.1.5 Loss of Material Due to Pitting and Crevice Corrosion for Aluminum Alloy Fire Protection Piping, Piping Components, and Piping Elements Exposed to Raw Water

LRA and SRP-LR Table 3.3.1, item 3.3.1-62 address the loss of material due to pitting and crevice corrosion for aluminum alloy fire protection piping, piping components, and piping elements exposed to raw water. The applicant proposes to manage this aging process through the use of its PSPM Program (reviewed in SER Section 3.0.3). The GALL Report recommends that this aging process be managed through the use of GALL AMP XI.M26, "Fire Protection." The proposed AMP is not consistent with the AMP proposed by the GALL Report. As a result, the applicant proposes that the AMR item 3.3.1-62 is consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited.

In its review of LRA item 3.3.1-62, the staff noted that the component under consideration is from the plant drain system as opposed to the fire protection system. While the staff agrees that the GALL Report item selected (3.3.1-62) is the best (and in this case the only) item available which considers loss of material from aluminum exposed to raw water, the staff finds that the difference in the function of the systems renders the GALL Report's recommendation of using the Fire Protection Program inappropriate. Given that the drain water to which these components will be exposed differs significantly from the raw water typically found in service water systems, the staff also views the use of GALL AMP XI.M20, "Open Cycle Cooling Water System," as inappropriate. The staff believes that the AMR item under consideration is not affected by aging effects other than loss of material due to corrosion. The staff also believes that inspection requirements other than visual inspection in AMPs, such as "Open Cycle Cooling Water," are the result of aging effects other than loss of material. As a result, the staff finds that a visual inspection program, such as that proposed by the applicant, will be effective in managing the aging of the components of this system which are exposed to untreated water.

On the basis of its review, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.1.6 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion, as well as Fouling and Lining/Coating Degradation of Steel Piping, Piping Components, and Piping Elements Exposed to Raw Water

LRA and SRP-LR Table 3.3.1, item 3.3.1-76 address the loss of material due to general, pitting, crevice, and MIC, as well as fouling and lining/coating degradation of steel piping, piping components, and piping elements exposed to raw water. The applicant proposes to manage this aging process through the use of its PSPM Program (reviewed in SER Section 3.0.3). The GALL Report recommends that this aging process be managed through the use of GALL AMP XI.M20, “Open Cycle Cooling Water System.” The proposed AMP is not consistent with the AMP proposed by the GALL Report. As a result, the applicant proposes that the AMR item 3.3.1-76 is consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited.

In its review of LRA item 3.2.1-76, the staff noted that the components covered belong to two different drain systems, the HV system, the OG system, and the radwaste system. Based on a review of chapter 2 of the LRA and applicable sections of the USAR, the staff concludes that the applicant incorrectly applied item 3.2.1-76 to describe these systems. This conclusion is based on the fact that the above named systems fail to meet the scope of the recommended AMP, “Open Cycle Cooling Water.” The scope of the open cycle cooling water system is substantially limited to systems which transfer heat from safety related systems to the ultimate heat sink. There is no evidence that such a function exists in the above named systems. Given that GL 89-13 does not apply to these systems, the staff concludes that a visual inspection program, such as that proposed by the applicant, will be effective in managing the aging of the components of this system which are exposed to untreated water.

On the basis of its review, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.1.7 Loss of Material Due to Pitting and Crevice Corrosion, as well as Fouling of Stainless Steel Piping, Piping Components, and Piping Elements Exposed to Raw Water

LRA and SRP-LR Table 3.3.1, item 3.3.1-79 address the loss of material due to pitting and crevice corrosion, as well as fouling of stainless steel piping, piping components, and piping elements exposed to raw water. The applicant proposes to manage this aging process through the use of its PSPM Program (reviewed in SER Section 3.0.3). The GALL Report recommends that this aging process be managed through the use of GALL AMP XI.M20, “Open Cycle Cooling Water System.” The proposed AMP is not consistent with the AMP proposed by the GALL Report. As a result, the applicant proposes that the AMR items associated with item 3.3.1-79 are consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited.

In its review of LRA item 3.3.1-79, the staff noted that the components covered belong to a drain system, the OG system, and the radwaste system. Based on a review of chapter 2 of the LRA and applicable sections of the USAR, the staff concludes that the applicant incorrectly applied item 3.3.1-79 to describe the SGTS. This conclusion is based on the fact that the above systems fail to meet the scope of the recommended AMP, “Open Cycle Cooling Water.” The scope of the open cycle cooling water system is substantially limited to systems which transfer heat from safety related systems to the ultimate heat sink. There is no evidence that such a function exists in the above named systems. Given that GL 89-13 does not apply to these systems, the staff concludes that a visual inspection program, such as that proposed by the applicant, will be effective in managing the aging of the components of this system which are exposed to untreated water.

On the basis of its review, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.1.8 Loss of Material Due to Pitting, Crevice Corrosion, and Fouling of Stainless Steel Piping, Piping Components, and Piping Elements Exposed to Raw Water

LRA and SRP-LR Table 3.3.1, item 3.3.1-79 address the loss of material due to pitting, crevice corrosion, and fouling of stainless steel piping, piping components, and piping elements exposed to raw water. The applicant proposes to manage this aging process through the use of its One-Time Inspection Program (reviewed in SER Section 3.0.3). The GALL Report recommends that this aging process be managed through the use of GALL AMP XI.M20, “Open Cycle Cooling Water System.” The proposed AMP is not consistent with the AMP proposed by the GALL Report. As a result, the applicant proposes that the AMR item 3.3.1-79 is consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited.

In its review of LRA item 3.3.1-79, the staff noted that the One-Time Inspection Program is designed to be used when the environment to which a SCC is exposed is invariant with time, for example treated water systems where the water chemistry is frequently monitored and carefully controlled. In such systems, the lack of prior corrosion may be an indicator that future corrosion will not occur. Raw water systems, including any untreated and substantially unmonitored water system, cannot be considered to be invariant with time in terms of chemistry or microbiology.

By letter dated July 14, 2009, the staff issued RAI 3.3.2.1-5 requesting that the applicant propose a program to manage the aging of the components under consideration which recognizes the variability of the chemistry and microbiology of raw water, and which acknowledges the inability to use past corrosion performance as an indicator of future corrosion under such circumstances.

In its response dated August 13, 2009, the applicant stated that the systems under consideration are the OG system and the radwaste system. The applicant also indicated that, while the chemistry of the water being considered is not directly controlled, it is derived (e.g., condensation) from water systems which are chemically controlled and which are not corrosive to stainless steel. The staff finds the applicant’s currently proposed AMP acceptable because the staff concurs with the applicant’s assessment that the water under consideration should not be corrosive to stainless steel. The staff finds that due to the chemical control of the source water, the chemical composition of the water under consideration will be sufficiently invariant that past corrosion history will be a reasonable indicator of future corrosion performance.

On the basis of its review, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.1.9 Loss of Material Due to Pitting, Crevice, and Microbiologically Influenced Corrosion, as well as Fouling for Copper Alloy Piping Exposed to Raw Water

LRA and SRP-LR Table 3.3.1, item 3.3.1-81 address the loss of material due to pitting, crevice, and MIC, as well as fouling for copper alloy piping, piping components, and piping elements exposed to raw water. The applicant proposes to manage this aging process through the use of its PSPM Program (reviewed in SER Section 3.0.3). The GALL Report recommends that this aging process be managed through the use of GALL AMP XI.M20, “Open Cycle Cooling Water

System." The proposed AMP is not consistent with the AMP proposed by the GALL Report. As a result, the applicant proposes that the AMR review items associated with item 3.3.1-81 are consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited.

In its review of LRA item 3.3.1-81, the staff noted that the components covered belong to two different drain systems, the N_2 system, and the radwaste system. Based on a review of chapter 2 of the LRA and applicable sections of the USAR, the staff concludes that the applicant incorrectly applied item 3.3.1-81 to describe these systems. This conclusion is based on the fact that the above named systems fail to meet the scope of the recommended AMP, "Open Cycle Cooling Water." The scope of the open cycle cooling water system is substantially limited to systems which transfer heat from safety-related systems to the ultimate heat sink. There is no evidence that such a function exists in the above named systems. Given that GL 89-13 does not apply to these systems, the staff concludes that a visual inspection program, such as that proposed by the applicant, will be effective in managing the aging of the components of this system which are exposed to untreated water.

On the basis of its review, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.1.10 Reduction of Heat Transfer Due to Fouling of Stainless Steel and Copper Alloy Heat Exchanger Tubes Exposed to Raw Water

LRA and SRP-LR Table 3.3.1, item 3.3.1-83 address the reduction of heat transfer due to fouling of stainless steel and copper alloy heat exchanger tubes exposed to raw water. The applicant proposes to manage this aging process through the use of its PSPM Program (reviewed in SER Section 3.0.3). The GALL Report recommends that this aging process be managed through the use of GALL AMP XI.M20, "Open Cycle Cooling Water System." The proposed AMP is not consistent with the AMP proposed by the GALL Report. As a result, the applicant proposes that the AMR items associated with item 3.3.1-83 are consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited.

In its review of LRA item 3.3.1-83, the staff noted that the item under consideration is the heating/cooling coil serving the N_2 system. The staff also noted that the aging effect under consideration is loss of heat transfer due to fouling. Based on the information presented in the application, the staff must assume that the applicant correctly chose to apply item 3.3.1-83 to this component. In the absence of additional information, the staff must also assume that GL 89-13 applies to the component under consideration.

By letter dated July 14, 2009, the staff issued RAI 3.3.2.1-7 requesting that the applicant propose an AMP equivalent to the Open Cycle Cooling Water Program or justify why GL 89-13 does not apply to this system. This justification should include a complete description of the water system associated with the N_2 system including the water source and its typical chemical composition.

In its response dated August 13, 2009, the applicant confirmed that GL 89-13 did not apply to the components under consideration. The applicant also indicated that the water source for these components was PW and rain water. These water sources reinforce the concept that the use of the Open Cycle Cooling Water System Program for these components is inappropriate. The applicant further indicated that the aging effect involved was loss of material. The staff noted that loss of material is detectible through visual inspection and that the applicant's PSPM Program includes visual inspection. The staff finds the applicant's currently proposed AMP acceptable because an appropriate inspection method is included in the program.

On the basis of its review, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.1.11 Loss of Material Due to Pitting, Crevice, and Microbiologically Influenced Corrosion and Fouling for Copper Alloy Components Exposed to Treated Water

LRA Table 3.3.1, item 3.3.1-70 addresses loss of material due to general, pitting, crevice, and MIC, and fouling for copper alloy piping, piping components, and piping elements exposed to raw water. The LRA credits the PSPM Program to manage this aging effect for copper alloy piping, tubing, and valve body components in a treated water (internal) environment only in the PW system. The GALL Report recommends GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" to manage this aging effect. The applicant indicated that the AMR line items associated with item 3.3.1-70 are consistent with GALL Report material, environment, and aging effect, but a different AMP is credited. The applicant indicated that this treated water environment includes water that has been treated but is not maintained by a chemistry control program; therefore, it is conservatively considered raw water.

The staff noted that for these AMR line items, the applicant referenced GALL AMR, item VII.G-24 and GALL Report Table 1, item 3.3.1-68, which are applicable to steel piping, piping components, and piping elements. However, in the LRA, the material that is listed for these AMR line items is copper alloy. By letter dated June 29, 2009, the applicant amended its LRA to correct the discrepancy between the material and the referenced GALL AMR line items. The staff noted that these AMR line items now reference LRA Table 3.3.1, item 3.3.1-70 and GALL AMR, item VII.G-12. The staff finds this acceptable because the applicant has amended its LRA to reference a more appropriate GALL AMR line item.

The staff reviewed the applicant's PSPM program and its evaluation is documented in SER Section 3.0.3. The staff determined that the PSPM Program, which includes periodic visual inspections of external surfaces performed during repetitive tasks or routine monitoring of plant operations, is adequate to manage loss of material for copper alloy piping, tubing, and valve body components exposed to treated water (internal) environment. The staff determined that this program will visually inspect the internal surfaces of a representative sample of copper alloy components in the PW system exposed to treated water (PW) to manage this aging effect. The staff noted that a visual inspection will be capable of identifying degradation on the internal surface that will present itself in signs of corrosion, corrosion byproducts, coating degradation, discoloration on the surface, scale/deposits and pits, and surface discontinuities that are indicative of loss of material. On the basis of periodic visual inspections being performed during repetitive tasks or routine monitoring of plant operations of these components by the PSPM Program, the staff finds the applicant's use of this program acceptable.

Based on its review, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.1.12 Loss of Material Due to Pitting, Crevice, and Galvanic Corrosion for Copper Alloy Components Exposed to Treated Water (Internal)

LRA Table 3.3.1, item 3.3.1-51 addresses loss of material due to pitting, crevice, and galvanic corrosion for copper alloy piping, piping components and piping elements, and heat exchanger components exposed to closed cycle cooling water.

The LRA credits the Water Chemistry Control – Auxiliary Systems Program to manage this aging effect for copper alloy greater than15 percent Zn or 8 percent Al and copper alloy piping, piping components, and piping elements in a treated water (internal) environment only. The GALL Report recommends GALL AMP XI.M21, "Closed Cycle Cooling Water" to manage this aging effect. The AMR line items that reference this line item cite LRA Note E, indicating that the AMR line items are consistent with GALL Report material, environment, and aging effect, but a different AMP is credited. The applicant also indicated that this environment does not directly correspond to the GALL Report definition of closed cycle cooling water. The applicant further indicated that water chemistry is maintained by the Water Chemistry Control – Auxiliary Systems Program, therefore, it approximates the GALL Report definition.

The staff noted that the applicant referenced GALL AMR, items VII.C2-4 and VII.F1-15, because the material and aging effect combination corresponded; however, these systems are not a closed cycle water systems. Therefore, it is not appropriate to credit the Water Chemistry Control – Closed Cycle Water Program for aging management. The applicant responded to RAI B.1.38-1 and its evaluation is documented in SER Section 3.0.3. In its letter dated June 15, 2009, the applicant indicated that based on the design of the AS system electric boiler, it requires a high level of water conductivity. The applicant further indicated that this high level of water conductivity propagates the electric arc generated by the boiler coil. The staff noted that because of the design and requirements of these electric boilers, the system is not suitable to be controlled by the EPRI guidelines for chemistry control of CCW referenced by the GALL Report. The applicant indicated that the design of the chilled water portion of the HV system have requirements on the parameters monitored to reflect the design of the components, so the EPRI guidelines are not suitable for these systems. The staff noted that the parameters monitored and acceptance criteria for these parameters are based on manufacturer's recommendations.

The staff reviewed the applicant's Water Chemistry Control – Auxiliary Systems Program and its evaluation is documented in SER Section 3.0.3. The staff noted that this program consists of sampling and analysis of water from these systems in order to minimize the exposure of an aggressive environment that may lead to loss of material and cracking. The staff further noted that this program includes certain acceptance criteria in accordance with industry guidelines, such as pH, conductivity, phosphate, sulfite, and iron in the ACD system and AS system and sodium nitrite in the HV system. Furthermore, the staff noted that the applicant is conservatively performing a one-time inspection of a sample of components most susceptible to this aging effect to verify the effectiveness of the Water Chemistry Control – Auxiliary Systems Program. The staff noted these AMR line items did not explicitly credit the One-Time Inspection Program; however, because a one-time inspection is integrated into the Water Chemistry Control – Auxiliary Systems Program, the staff finds this to be acceptable. The staff determined that maintaining water chemistry in these systems will be capable of mitigating loss of material and cracking and that the one-time inspection is conservative and will provide verification of the program's effectiveness.

Based on the programs identified, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.1.13 Loss of Material Due to Pitting and Crevice Corrosion for Stainless Steel Exposed to Treated Water Greater Than 140 °F (Internal) or Treated Water (Internal)

LRA Table 3.3.1, item 3.3.1-50 addresses loss of material due to pitting and crevice corrosion for stainless steel piping, piping components, and piping elements exposed to closed cycle cooling water in the ACD system, AS system, and HV system.

The LRA credits the Water Chemistry Control – Auxiliary Systems Program to manage this aging effect for stainless steel piping, piping components, and piping elements in a treated water greater than 140 °F (internal) or treated water (internal) environment only. The GALL Report recommends GALL AMP XI.M21, “Closed Cycle Cooling Water” to manage this aging effect. The applicant indicated that the AMR line items associated with item 3.3.1-50 are consistent with GALL Report material, environment, and aging effect, but a different AMP is credited. The applicant also indicated that this environment does not directly correspond to the GALL Report definition of closed cycle cooling water. The applicant further indicated that water chemistry is maintained by the Water Chemistry Control – Auxiliary Systems Program; therefore, it approximates the GALL Report definition.

The staff noted that the applicant referenced this GALL AMR line item because it was the same material and aging effect combination; however, these systems are not a closed cycle water system. Therefore, it is not appropriate to credit the Water Chemistry Control – Closed Cycle Water Program for aging management as the GALL Report recommends. The applicant responded to RAI B.1.38-1 and its evaluation is documented in SER Section 3.0.3. In its letter dated June 15, 2009, the applicant indicated that based on the design of the AS system electric boiler, it requires a high level of water conductivity. The applicant further indicated that this high level of water conductivity propagates the electric arc generated by the boiler coil. The staff noted that because of the design and requirements of these electric boilers, the system is not suitable to be controlled by the EPRI guidelines for chemistry control of CCW referenced by the GALL Report. The applicant indicated that the design of the chilled water portion of the HV system has requirements on the parameters monitored to reflect the design of the components, such that the EPRI guidelines are not suitable for these systems. The staff noted that the parameters monitored and acceptance criteria for these parameters are based on manufacturer’s recommendations.

The staff reviewed the applicant’s Water Chemistry Control – Auxiliary Systems Program and its evaluation is documented in SER Section 3.0.3. The staff noted that this program consists of sampling and analysis of water from these systems in order to minimize the exposure of an aggressive environment that may lead to loss of material and cracking. The staff further noted that this program includes certain acceptance criteria in accordance with industry guidelines, such as pH, conductivity, phosphate, sulfite, and iron in the ACD system and AS system and sodium nitrite in the HV system. Furthermore, the staff noted that the applicant is conservatively performing a one-time inspection of a sample of components most susceptible to this aging effect to verify the effectiveness of the Water Chemistry Control – Auxiliary Systems Program. The staff noted these AMR line items did not explicitly credit the One-Time Inspection Program because it is integrated into the Water Chemistry Control – Auxiliary Systems Program, and the staff finds this to be acceptable. The staff determined that maintaining water chemistry in these systems will be capable of mitigating loss of material and cracking and that the one-time inspection is conservative and will provide verification of the program’s effectiveness.

Based on its review, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.1.14 Loss of Material Due to Pitting and Crevice Corrosion for Stainless Steel Components Exposed to Internal Condensation

LRA Table 3.3.1, item 3.3.1-54 addresses loss of material due to pitting and crevice corrosion for stainless steel compressed air system piping, piping components, and piping elements exposed to internal condensation in the DG system and the SA system.

The LRA credits the PSPM Program to manage this aging effect for stainless steel compressed air system piping, piping components, and piping elements in an internal condensation environment only in the DG system. The LRA credits the One-Time Inspection Program to manage this aging effect for stainless steel compressed air system piping, piping components, and piping elements in an internal condensation environment only in the SA system. The GALL Report recommends GALL AMP XI.M24, "Compressed Air Monitoring" to manage this aging effect. The applicant indicated that the AMR line items associated with item 3.3.1-54 are consistent with the GALL Report material, environment, and aging effect, but a different AMP is credited.

The staff noted that the GALL AMP XI.M24 recommendations include (a) frequent leak testing of valves, piping, and other system components, especially those made of carbon steel and stainless steel; and (b) preventive monitoring that checks air quality at various locations in the system to ensure that oil, water, rust, dirt, and other contaminants are kept within the specified limits. However, the applicant's proposed programs will perform only visual, NDE, or both types of inspections of the components addressed by these AMR line items. Therefore, by letter dated July 13, 2009, the staff issued RAI 3.3-3 requesting the applicant justify the use of the PSPM Program or the One-Time Inspection Program, that performs visual, NDE, or both techniques when the GALL Report recommends periodic system and component tests, including leak rate tests on the system and on individual items of components. In its response dated August 13, 2009, the applicant stated that since the DG system and the SA system do not contain air dryers and may also normally be isolated from the rest of the system, air quality and leakage monitoring will not be effective in aging management. The staff noted air dryers are used to remove water and other contaminants from compressed air; however, since these systems do not contain air dryers, the staff agrees that maintaining air quality will not be effective for aging management. The applicant further indicated both of these programs provide for visual inspections or other NDE techniques to detect loss of material. The staff noted that the use of either visual inspections or NDE techniques is recommended in the GALL Report as being capable of detecting loss of material. The staff finds the applicant's proposed programs acceptable because (1) the applicant justified that air quality and leakage monitoring will not be effective for aging management for these systems and (2) the applicant justified the use of the PSPM Program and the One-Time Inspection Program will be capable of detecting loss of material consistent with the recommendations of the GALL Report for detection of this aging effect.

The staff reviewed the applicant's PSPM Program and its evaluation is documented in SER Section 3.0.3. The staff determined that this program, which includes periodic visual inspections of the internal surfaces performed during repetitive tasks or routine monitoring of plant operations, is adequate to manage loss of material for stainless steel components exposed to a condensation (internal) environment. The staff noted that a visual inspection will be capable of identifying degradation on the external surface that will present itself in signs of corrosion, corrosion byproducts, coating degradation, discoloration on the surface, scale/deposits, and pits and surface discontinuities that are indicative of loss of material. On the basis of periodic visual inspections being performed during repetitive tasks or routine monitoring of plant operations of these components by the PSPM Program, the staff finds the applicant's use of this program acceptable.

The staff reviewed the applicant's One-Time Inspection Program and its evaluation is documented in SER Section 3.0.3. The staff determined that this program, which includes a visual or other NDE inspection technique, consistent with the recommendations of GALL AMP XI.M32, of the internal surfaces which will be performed within the 10 years prior to the period of extended operation so that sufficient time has elapsed for aging effects, if any, to be manifest. The staff also determined that this is adequate to manage loss of material for stainless steel components exposed to a condensation (internal) environment. On the basis of a visual inspection or other NDE inspection technique that is capable of detecting loss of material, consistent with the recommendations of GALL AMP XI.M32, by the One-Time Inspection Program, the staff finds the applicant's use of this program acceptable.

Based on its review, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.1.15 Loss of Material Due to General, Pitting and Crevice Corrosion for Steel Components Exposed to Treated Water Greater Than 140 ^{o}F (Internal) or Treated Water (internal)

LRA Table 3.3.1, item 3.3.1-47 addresses loss of material due to general, pitting, and crevice corrosion for steel piping components, piping elements, tanks, and heat exchanger components exposed to closed cycle cooling water.

The LRA credits the Water Chemistry Control – Auxiliary Systems Program to manage this aging effect for gray cast iron piping, piping components, and piping elements in a treated water greater than 140 ^{o}F (internal) or treated water (internal) environment only in the ACD system, AS system, and HV system. The GALL Report recommends GALL AMP XI.M21, "Closed Cycle Cooling Water" to manage this aging effect. The applicant indicated that AMR line items associated with item 3.3.1-47 are consistent with GALL Report material, environment, and aging effect, but a different AMP is credited. The applicant also indicated that this environment does not directly correspond to the GALL Report definition of closed cycle cooling water. The applicant further indicated that water chemistry is maintained by the Water Chemistry Control – Auxiliary Systems Program and, therefore, it approximates the GALL Report definition. The staff notes that the applicant defines the environment as "treated water" because it is controlled by a chemistry program; however, these systems are not exposed to closed cycle cooling water.

The staff noted that the applicant referenced this GALL AMR line item because it was the same material and aging effect combination; however, these systems are not a closed cycle water system. Therefore, it is not appropriate to credit the Water Chemistry Control – Closed Cycle Water Program for aging management. The applicant responded to RAI B.1.38-1 and its evaluation is documented in SER Section 3.0.3. In its letter dated June 15, 2009, the applicant indicated that based on the design of the AS system electric boiler, it requires a high level of water conductivity. The applicant further indicated that this high level of water conductivity propagates the electric arc generated by the boiler coil. The staff noted that because of the design and requirements of these electric boilers, the system is not suitable to be controlled by the EPRI guidelines for chemistry control of CCW referenced by the GALL Report. The applicant indicated that the design of the chilled water portion of the HV system has requirements on the parameters monitored to reflect the design of the components, such that the EPRI guidelines are not suitable for these systems. The staff noted that the parameters monitored and acceptance criteria for these parameters are based on manufacturer's recommendations.

The staff reviewed the applicant's Water Chemistry Control – Auxiliary Systems Program and its evaluation is documented in SER Section 3.0.3. The staff noted that this program consists of sampling and analysis of water from these systems in order to minimize the exposure of an aggressive environment that may lead to loss of material and cracking. The staff further noted that this program includes certain acceptance criteria in accordance with industry guidelines, such as pH, conductivity, phosphate, sulfite, and iron in the ACD system and AS system and sodium nitrite in the HV system. Furthermore, the staff noted that the applicant is conservatively performing a one-time inspection of a sample of components most susceptible to this aging effect to verify the effectiveness of the Water Chemistry Control – Auxiliary Systems Program. The staff noted these AMR line items did not explicitly credit the One-Time Inspection Program because it is integrated into the Water Chemistry Control – Auxiliary Systems Program, and the staff finds this to be acceptable. The staff determined that maintaining water chemistry in these systems will be capable of mitigating loss of material and cracking and that the one-time inspection is conservative and will provide verification of the program's effectiveness.

Based on its review, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.1.16 Loss of Material Due to General Corrosion for Steel Components Exposed to Air-Indoor (External)

LRA Table 3.3.1, item 3.3.1-58 addresses loss of material due to general corrosion for steel external surfaces exposed to air-indoor uncontrolled (external), air-outdoor (external), and condensation (external).

The LRA credits the PSPM Program to manage this aging effect for steel piping, piping components, and piping elements in an air-indoor (external) environment only in the plant drains system. The GALL Report recommends GALL AMP XI.M36, "External Surfaces Monitoring" to manage this aging effect. The applicant indicated that the AMR line items associated with item 3.3.1-58 are consistent with GALL Report material, environment, and aging effect, but a different AMP is credited.

The staff noted that GALL AMP XI.M36 indicates that inspections are normally performed on a frequency that exceeds once per fuel cycle and the intervals may be adjusted as necessary based on plant-specific inspection results and industry experience. The staff also notes that SRP-LR Section A.1.2.3.4 indicates that inspection frequencies may be linked to plant-specific or industry-wide OE. The staff further notes that LRA Section B.1.31 states: "Inspection and test intervals are dependent on component material and environment and take into consideration industry and plant-specific OE and manufacturers' recommendations. Each inspection or test occurs at least once every five years." On the basis of its review, the staff finds that because the applicant's inspection interval is dependent on the material/environment combination and takes into consideration industry and plant-specific OE and manufacturers' recommendations, the applicant is consistent with the recommendations of the GALL Report.

The staff reviewed the applicant's PSPM Program and its evaluation is documented in SER Section 3.0.3. The staff determined that the PSPM Program, which includes periodic visual inspections of external surfaces performed during repetitive tasks or routine monitoring of plant operations, is adequate to manage loss of material for gray cast iron piping, piping components, and piping elements exposed to an air-indoor (external) environment. The staff noted that a visual inspection will be capable of identifying degradation on the external surface that will present itself in signs of corrosion, corrosion byproducts, coating degradation, discoloration on the surface, scale/deposits, and pits and surface discontinuities that are indicative of loss of material. The staff determines that the activities of this program are consistent with the activities recommended in GALL AMP XI.M36, to perform periodic visual inspections of the components withinin the scope of this program. On the basis of periodic visual inspections being performed during repetitive tasks or routine monitoring of plant operations of these components by the PSPM Program, the staff finds the applicant's use of this program acceptable.

Based on its review, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.1.17 Cracking Due to Stress-Corrosion Cracking in the Reactor Water Cleanup System

LRA Table 3.3.1, item 3.3.1-37 describes the IGSCC of stainless steel piping, piping elements, and piping components of the RWCU system. In more detail, LRA Table 3.3.2-14-24 addressed the AMR items corresponding to LRA item 3.3.1-37 as part of the applicant's aging management evaluation of the RWCU system.

LRA Appendix B, Table B-2 indicates that GALL AMP XI.M25, "BWR Reactor Water Cleanup System," was not credited for the applicant's aging management. In the discussion column for LRA Table 3.3.1, item 3.3.1-37, the applicant states that the IGSCC of stainless steel components of the RWCU system is managed by the applicant's Water Chemistry Control – BWR Program and the One-Time Inspection Program will be used to verify the effectiveness of the Water Chemistry Program. The LRA item also states that the applicant has complied with the recommendations of GL 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance" and replaced portions of the RWCU system piping with IGSCC-resistant material. The applicant also stated that it has performed the inspections specified by GL 88-01, 'NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping,' with no significant IGSCC on piping that was not replaced with the IGSCC-resistant material.

In order to check the consistency of the LRA AMR items with the GALL Report, the staff reviewed LRA item 3.3.1-37 in comparison with GALL Report, Volume 1, Table 3, ID 37. In the review of the RWCU system stainless steel IGSCC, the staff found that the applicant-stated combination of component, material, environment, and aging effect/mechanism was consistent with the combination in GALL Report, Volume 1, Table 3.

In addition, the staff compared the detailed AMR items in LRA Table 3.3.2-14-24 with the corresponding item VII.E3-16 in GALL Report ,Volume 2, Table VII.E3. The LRA AMR items were consistent with the GALL Report in material, environment, and aging effect, but a different AMP was credited as indicated by the applicant's consistency with LRA Note E. The staff noted that the applicant credited the Water Chemistry Control – BWR Program for the aging management of RWCU system stainless steel IGSCC. The applicant also credited the One-Time Inspection Program for verifying the effectiveness of the water chemistry program.

In its review of the LRA and references related to the RWCU system piping inspection, the staff identified a potential conflict in the applicant's aging management approach with the recommendations of GALL AMP XI.M25 regarding the inspection extent and schedule to manage the IGSCC of the RWCU system stainless steel outboard piping. The GALL Report recommends that if the RWCU system has piping that is not resistant to IGSCC, the following three criteria should be met to discontinue the IGSCC inspection of the RWCU system piping welds outboard of the second isolation valve:

(a) satisfactory completion of GL 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance"

(b) no IGSCC detected in RWCU piping welds inboard of the second isolation valve (ongoing GL 88-01 inspection)

(c) no IGSCC detected in RWCU piping welds outboard of the second isolation valve after inspecting a minimum of 10 percent of the susceptible piping welds

The GALL Report also indicated that if the piping is made of a material that is resistant to IGSCC, the completion of GL 89-10 (meeting the first criteria) is sufficient to discontinue the inspection of the piping outboard of the second isolation valve and for plants that meet only item (a) of the three criteria described above (i.e., satisfactory completion of all actions requested in GL 89-10), GALL AMP XI.M25, "Reactor Water Cleanup System," recommends inspection of at least 2 percent of the welds or two welds every fueling outage, whichever sample is larger, in the piping outboard of the second isolation valve.

Based on the LRA and reference information described above, the staff noted that it is not clear whether or not the applicant met all of the three criteria to discontinue the IGSCC inspection of the RWCU system outboard piping. Therefore, by letter dated May 1, 2009, the staff issued RAI 3.3.1-1 requesting the applicant to (a) clarify whether or not all of the three criteria are met to discontinue the inspections of the outboard piping of the RWCU system, and (b) if all of the three criteria are not met, to describe what inspections will be performed for the inboard and outboard portions of the RWCU system piping, respectively, over the extended period of operation. The applicant responded to the RAI by letter dated June 15, 2009 and the applicant stated that since CNS completed the actions associated with GL 89-10 on motor-operated valves, criterion (a) has been met. The applicant also stated that the piping inboard of the second isolation valve (four inch or greater, at or above 200 °F) has been replaced with IGSCC-resistant material, which, on the basis of the additional option above, effectively satisfies criterion (b).

The applicant further stated that some RWCU piping (four inch or greater, at or above 200°F) outboard of the second isolation valve has been replaced with IGSCC-resistant material. The applicant stated that the replaced piping had no susceptible welds. In addition, the applicant stated that of the remaining non-resistant RWCU piping outboard of the second isolation valve, an inspection of more than 10 percent of the welds found no indication of IGSCC, which satisfies criterion (c) and, therefore, all three criteria are met to discontinue the inspections of the outboard piping of the RWCU system.

In its response to the RAI, the applicant clarified that criterion (a) was satisfied and criterion (b) was satisfied effectively by replacing the piping inboard of the second isolation valve with IGSCC-resistant material. In addition, the applicant confirmed that an inspection of more than 10 percent of the remaining non-resistant welds outboard of the second isolation valve was conducted after the replacement of a portion of the outboard piping with IGSCC-resistant material and the inspection found no indication of IGSCC.

In its review, the staff found that the applicant effectively meets the foregoing criteria that the GALL Report recommends for the discontinuation of the inspections of the piping outboard of the second isolation valve with one item of concern. The concern, which the staff noted, was that before the replacement of the outboard piping with IGSCC-resistant material, IGSCC indications had been observed in the outboard piping of the RWCU system. Therefore, the staff found a need to verify whether or not the observed aging effects of IGSCC are occurring very slowly in the outboard piping of the RWCU system. Based on the foregoing review results, the staff further performed the following evaluation of the applicant's aging management for the AMR items in consideration of the concern.

The staff noted that the Water Chemistry Control – BWR Program is credited for the aging management of IGSCC for the AMR items in conjunction with the One-Time Inspection Program for verifying the effectiveness of the Water Chemistry Program. The staff reviewed the applicant's Water Chemistry Control – BWR Program and One-Time Inspection Program. The review results of these AMPs are documented in SER Section 3.0.3.

In its review, the staff finds the Water Chemistry Control – BWR Program is capable of mitigating the aging effects of cracking that can be caused by SCC. The staff also finds that this program controls water chemistry to minimize the environmental degradation of the components by maintaining the relevant water chemistry and limiting the levels of contaminants in the RCS that may cause cracking. The staff finds the One-Time Inspection Program, which performs inspections of selected components, including the areas of low or stagnant flow, is capable of detecting cracking and loss of material due to general, pitting, and crevice corrosion, if it should occur in the selected components. In addition, the staff finds that the One-Time Inspection Program is adequate to verify whether or not the aging effects of IGSCC are progressing very slowly in the components so that the intended functions of the RWCU system outboard piping are maintained properly. Therefore, the staff finds that the AMPs which the applicant credited for the AMR items are acceptable to manage the aging effects and satisfy the need for verifying that IGSCC is occurring very slowing in the components. The staff also finds that the review results resolved the foregoing concern that the staff identified in relation to the verification that IGSCC is occurring very slowly in the components.

On the basis that the Water Chemistry Control – BWR Program maintains adequate water chemistry and levels of contaminants to mitigate aging mechanisms that can cause cracking and the effectiveness of this program is verified with a one-time inspection to inspect selected components, including the areas of low or stagnant flow, the staff finds the use of these programs acceptable to manage the aging effects of IGSCC for the AMR items.

On the basis of its review, the staff determines that the applicant's proposed programs are acceptable for managing the aging effects in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.1.18 Cracking Due to Stress-Corrosion Cracking with LRA Note E in Relation with LRA Table 1, item 3.3.1-38

In LRA Tables 3.3.2-2, 3.3.2-14-3, 3.3.2-14-13, 3.3.2-14-16, and 3.3.2-14-21, the applicant addressed the AMR items of stainless steel piping, piping components, and piping elements in the auxiliary systems that are subject to cracking due to SCC in a treated water environment (greater than 140 °F). The applicant indicated that these AMR items are consistent with the GALL Report, but a different AMP is credited. The staff noted that where the GALL Report recommends GALL AMP XI.M7, "BWR Stress-Corrosion Cracking," with GALL AMP XI.M2, "Water Chemistry," the applicant proposed using the Water Chemistry Control – BWR Program in conjunction with the One-Time Inspection Program to verify the effectiveness of the Water Chemistry Control Program as described in LRA Table 3.3.1, item 3.3.1-38.

However, the staff found that in LRA Tables 3.3.2-2, 3.3.2-14-3, 3.3.2-14-13, 3.3.2-14-16, and 3.3.2-14-21, the AMR items credited only the Water Chemistry Control – BWR Program with no additional note for the One-Time Inspection Program in contrast to the description in LRA Table 3.3.1, item 3.3.1-38. The staff required additional information to complete its review of these AMR items. Therefore, the staff issued RAI 3.1.2.1-1, by letter dated June 29, 2009, requesting that the applicant clarify if the One-Time Inspection Program will be used in conjunction with the Water Chemistry Control – BWR Program to manage the aging effect of the AMR items. The applicant responded to the RAI by letter dated July 29, 2009. In the response, the applicant stated that in LRA Sections B.1.29 and B.1.39, the One-Time Inspection Program provides verification of the effectiveness of the Water Chemistry Control – BWR Program for all component, material, and environment combinations that credit the Water Chemistry Control Program. The applicant also stated that this includes the management of cracking as listed in LRA Tables 3.1.2-3, 3.2.2-1, 3.2.2-8-1, 3.2.2-8-3, 3.2.2-8-4, 3.3.2-2, 3.3.2-14-3, 3.3.2-14-13, 3.3.2-14-16, and 3.3.2-14-21.

The applicant further stated that a plant-specific note referring to the One-Time Inspection Program is included in the LRA tables wherever the comparable NUREG-1801 line item recommends both the Water Chemistry and One-Time Inspection programs. In addition, the applicant stated that for those line items compared to NUREG-1801 line items that do not specify one-time inspections, the note is not used, even though the One-Time Inspection Program applies wherever the Water Chemistry Program is credited.

As described above, the applicant clarified that although the aforementioned AMR tables did not include a plant-specific note referring to the One-Time Inspection Program, the foregoing AMR items credit the One-Time Inspection Program to verify the effectiveness of the Water Chemistry Control – BWR Program in the aging management of the SCC. Therefore, the applicant's response to the RAI resolved the foregoing issue related to the absence of the plant-specific note referring to the One-Time Inspection Program for the AMR items.

The staff further noted that the applicant also indicated that none of the system components are within the scope of the BWR SCC Program as all relevant components are included in the RV, RVIs, and RCS. The staff reviewed the AMR items in comparison with SRP-LR Table 3.3-1, relevant sections of the SRP-LR, GALL Report, Volume 1, Table 3 and GALL Report, Volume 2, Table VII.E4 (item VII.E4-15). In its review, the staff found that the guidance documents recommend the BWR SCC Program, as well as the Water Chemistry Program to manage the SCC for the AMR items. In addition, the staff found the applicant's statement indicates that the some auxiliary systems components within the scope of the BWR SCC Program were credited with a different AMP rather than the BWR SCC Program recommended by the GALL Report.

Therefore, the staff issued RAI B.1.7-3, by letter dated May 1, 2009, requesting the applicant to clarify what portions of the auxiliary systems are managed by the BWR SCC Program and to describe what AMP is used to manage SCC in the other portions of the auxiliary systems if an AMP other than the BWR SCC Program is used. The applicant responded to the RAI by letter dated June 15, 2009. In the response, the applicant stated that in NUREG-1801, the BWR SCC Program includes all BWR austenitic stainless steel piping that is 4 inches or larger in nominal diameter and that contains reactor coolant at temperatures above 200 °F during power operation regardless of ASME Code classification. The applicant also stated that since most of RHR, HPCI, and RCIC components are normally in standby at ambient temperatures (less than 200 °F) during power operation, they are not included in the program. The applicant further stated that the portions of the ESFs and auxiliary systems exposed to reactor coolant at temperatures greater than 200 °F during power operation are Class 1 components evaluated as part of the RCPB and the AMR results for these components appear in Table 3.1.2-3.

In addition, the applicant stated that the Water Chemistry Control – BWR Program, along with the One-Time Inspection Program to verify the Water Chemistry Program's effectiveness, manages stress corrosion for these ESFs and auxiliary systems components and this is consistent with other NUREG-1801 items (e.g., GALL Report, Volume 2, item VIII.E-31).

In its response, the applicant clarified that the relevant Class 1 components within the scope of the BWR SCC Program are evaluated as part of the RCPB and the staff confirmed that Table 3.1.2-3 indicates that the BWR SCC Program is credited for Class 1 components to manage SCC for the Class 1 components. In addition, the applicant's response to the RAI clarified that the Water Chemistry Control – BWR Program, along with the One-Time Inspection Program to verify the Water Chemistry Program's effectiveness, manages SCC for the components and the AMR results are consistent with other AMR items in the GALL Report, (e.g., GALL Report, Volume 2, item VIII.E-31).

In relation to the applicant's response to the RAI, the staff noted that GALL Report, Volume 2, Table VIII, item VIII.E-31 recommends GALL AMP XI.M2, "Water Chemistry," for BWR water with GALL AMP XI.M32, "One-Time Inspection," to manage the SCC for piping, piping components, and piping elements in the condensate system of the steam and power conversion (S&PC) system, which are exposed to treated water greater than 140 °F. In its review, the staff noted that the applicant's aging management approach is consistent with the recommendation of the GALL Report for GALL Report, Volume 2, item VIII.E-31.

The staff also reviewed the applicant's Water Chemistry Control – BWR Program and One-Time Inspection Program. The review results of the AMPs are documented in SER Section 3.0.3. In its review, the staff finds the Water Chemistry Program is capable of mitigating the aging effect of cracking that can be caused by SCC. The staff also finds that this program controls water chemistry to minimize the environmental degradation of the components by maintaining the relevant water chemistry and limiting the levels of contaminants, such as chloride and sulfate in the auxiliary systems that may cause cracking due to SCC. The staff finds that the One-Time Inspection Program, which performs inspections of selected components, including the areas of low or stagnant flow, is capable of detecting cracking due to SCC, if it should occur in the selected components. The staff also finds that the One-Time Inspection Program is adequate to verify whether the aging effect of cracking is progressing very slowly or not occurring in the components so that the intended functions of the components are maintained during the period of extended operation. On the basis of its review, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components.

On the basis of its review, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.1.19 Cracking Due to Stress-Corrosion Cracking with LRA Note D in Relation with LRA Table 1, item 3.3.1-46

In LRA Table 3.3.2-4, page 3.3-96, the applicant addressed the stainless steel valve body in the DG system of the auxiliary systems that is subject to cracking due to SCC in a treated water environment (greater than 140 °F). An associated note indicated that the treated water environment is the jacket cooling water for the DG. The applicant credited the Water Chemistry Control – Closed Cooling Water Program for the aging management. The applicant also indicated that the consistency note for the AMR item is LRA Note D, which means that the AMR item is consistent with the GALL Report in terms of material, environment, aging effect, and AMP, but the component is different. In LRA Table 3.3.1, item 46 related to the AMR item, the applicant indicated that some of the components credit the Water Chemistry Control – Closed Cooling Water Program to manage the aging effect of stainless steel SCC and the One-Time Inspection Program will be used to verify the effectiveness of the Water Chemistry Program.

The staff reviewed the applicant's AMR results in comparison with SRP-LR Table 3.3-1, item 46, SRP-LR Section 3.3.2.1, and GALL Report, Volume 2, Table VII.C2, item VII.C2-11. In its review, the staff found that the AMR review results in the LRA were adequate and acceptable, in accordance with the guidance documents except for the component and exception to the AMP and the LRA Note D was relevant.

The staff finds that the Water Chemistry Control – Closed Cooling Water Program, in addition to the One-Time Inspection Program, is adequate to manage the aging effect for this AMR item. The staff reviewed that the Water Chemistry Control – Closed Cooling Water Program and the review results of the AMP are documented in SER Section 3.0.3.

The staff determines that the applicant's proposed program is acceptable for managing the aging effect in the applicable component. The staff concludes that the applicant has demonstrated that the effect of aging for the component will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.1.20 Cracking Due to Stress-Corrosion Cracking with LRA Note E In Relation with LRA Table 1, item 3.3.1-46

In LRA Table 3.3.2-14-1, pages 3.3-156, 157, and 158 and LRA Table 3.3.2-14-2, pages 3.3-164 and 166, the applicant addressed the stainless steel trap, tubing, and valve body in ACD system and stainless steel tubing and valve body in the AS system that are subject to cracking due to SCC in a treated water environment (greater than 140 °F). The applicant credited the Water Chemistry Control – Auxiliary Systems Program for the aging management. The applicant also indicated that the consistency note for the AMR item is LRA Note E, which means that the AMR item is consistent with the GALL Report in terms of component, material, environment, and aging effect, but a different AMP is credited for the aging management. The staff noted that where the GALL Report recommends GALL AMP XI.M21, "Closed Cycle Cooling Water System," the applicant proposed using the Water Chemistry Control – Auxiliary System Program. The staff noted that LRA Table B-2 also indicated that the Water Chemistry

Control – Closed Cooling Water Program correlates with GALL AMP XI.M21, “Closed Cycle Cooling Water System.”

In LRA Table 3.3.1, item 46, the applicant also indicated that some of the components, which do not credit the Water Chemistry Control – Closed Cooling Water Program, credit the Water Chemistry Control – Auxiliary Systems to manage SCC. Using LRA Note 306 for LRA Tables 3.3.2-1 through 3.3.2-14-29, the applicant indicated that although the treated water environment for the AMR items does not directly compare with any environment defined in the GALL Report, it approximates the GALL Report defined closed cycle cooling water environment.

The staff reviewed the applicant’s AMR results in comparison with SRP-LR Table 3.3-1, item 46, SRP-LR Section 3.3.2.1, and GALL Report, Volume 2, Table VII.C2, item VII.C2-11. In its review, the staff found that the AMR review results in the LRA were adequate and acceptable in accordance with the guidance documents except for the AMP credited for the AMR items as the applicant indicated with the LRA Note E. The staff also noted that the AMR items addressed the aging management of components in the ACD system and AS system. In addition, the staff noted that the applicant’s Water Chemistry Control – Auxiliary Systems Program is an existing program that specifically manages loss of material and cracking in ACD system components, AS system components, and HV system components to minimize component exposure to aggressive environments as addressed in LRA Section B.1.38.

To determine the adequacy of the credited program for managing the aging effect, the staff reviewed the Water Chemistry Control – Auxiliary Systems Program and the review results of the AMP are documented in SER Section 3.0.3. In its review, the staff finds that the Water Chemistry Control Program includes the monitoring and control of water, which the ACD system components and AS system components are exposed to, and the program minimizes the exposure of the components to aggressive environments that can result in cracking and loss of material in the components. In addition, the staff finds that as addressed in LRA Sections B.1.38 and B.1.29 the verification of the effectiveness of the Water Chemistry Control Program using the One-Time Inspection Program is acceptable to ensure that significant degradation is not occurring in the components and the intended functions of the components are maintained during the period of extended operation. Therefore, the staff finds that the Water Chemistry Control – Auxiliary Systems Program is adequate to manage the SCC of the AMR items.

On the basis of its review, the staff determines that the applicant’s proposed program is acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effect of aging for the components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.1.21 Carbon Steel Bolts and Fasteners Externally Exposed to Raw Water

In LRA Table 3.3.2-3, the applicant proposed to manage loss of material for carbon steel bolts and fasteners externally exposed to a raw water environment using the Bolting Integrity Program. The AMR line item cites LRA Note E, which indicates that the aging management program credited is different from that which is recommended by the GALL Report.

The LRA credits the CNS AMP B.1.2 “Bolting Integrity Program” to manage this aging effect as opposed to the GALL Report AMP XI.M20 “Open-Cycle Cooling Water System”. The staff’s evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3. The applicant explained that the bolting line items in question are located in submerged environments. Bolts in these environments are coated or wrapped, and the inspection of these coatings and wrappings are conducted in accordance with the Buried Piping and Tanks and Periodic Surveillance and Preventive Maintenance programs. In cases where inspection reveals that bolts were exposed due to degradation or removal of the coating or wrappings for maintenance, the elements of the Bolting Integrity program would be implemented to assure that the intended function of the bolting is maintained. The staff verified that the Bolting Integrity Program is an existing CNS program that will manage the loss of material aging effect for carbon steel bolts and fasteners in the raw water environment listed, through periodic inspection, maintenance, and preventive measures in accordance with the recommendations specified by the GALL Bolting Integrity Program. On the basis of its review, the staff finds that because these components will be inspected through the specifications of the Bolting Integrity Program, they will be adequately managed.

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 the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, in accordance with 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

In LRA Section 3.3.2.2, the applicant provided further evaluation of aging management, as recommended by the GALL Report, for the auxiliary systems components and provides information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- reduction of heat transfer due to fouling
- cracking due to SCC
- cracking due to SCC and cyclic loading (PWR, not applicable)
- hardening and loss of strength due to elastomer degradation
- reduction of neutron-absorbing capacity and loss of material due to general corrosion
- loss of material due to general, pitting, and crevice corrosion
- loss of material due to general, pitting, crevice, and MIC
- loss of material due to general, pitting, crevice, MIC, and fouling
- loss of material due to pitting and crevice corrosion
- loss of material due to pitting, crevice, and galvanic corrosion
- loss of material due to pitting, crevice, and MIC
- loss of material due to wear
- loss of material due to underclad cracking (PWR, not applicable)
- QA for aging management of nonsafety-related components

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which the report recommends further evaluation, the staff reviewed the applicant’s evaluation to determine if it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant’s further evaluations against the criteria contained in SRP-LR Section 3.3.2.2. The staff provides the review of the applicant’s further evaluation as follows.

3.3.2.2.1 Cumulative Fatigue Damage for Auxiliary Systems

In LRA Section 3.3.2.2.1, the applicant indicated that metal fatigue in auxiliary systems is a TLAA, as defined in 10 CFR 54.3, which must be evaluated in accordance with 10 CFR 54.21(c)(1). The applicant indicated that the evaluation of this TLAA is addressed in LRA Section 4.3. However, it is unclear to the staff whether LRA Section 4.3 has covered fatigue TLAA for the components under auxiliary systems, as the applicant claimed. The staff issued RAI 3.1-2, in a letter dated June 29, 2009, requesting the applicant to list the components that have the TLAA evaluated for auxiliary systems. The applicant's response to RAI 3.1-2 is acceptable.

In reviewing LRA Tables 3.3.2-2 through 3.3.2-14-24, the staff found that the applicant identified 47 items subject to metal fatigue TLAA. Of these, 41 are consistent with the GALL Report, as identified by referencing to LRA Notes A and C. Of those items cited with LRA Note C, 16 are also cited with LRA Note 305, which states: "This steam or treated water environment is controlled by the Water Chemistry Control – Auxiliary Systems Program. Although this environment does not directly compare with any NUREG-1801 defined environment." Reviewing the definitions, the staff found that LRA Note C and LRA Note 305 contradict each other because LRA Note C says that everything is consistent with the GALL Report, including environment, except for the component. With this concern, the staff issued RAI 3.1-3, in a letter dated June 29, 2009, requesting the applicant to:

(a) Provide the basis regarding referencing of LRA Note 305 to the 16 items mentioned in the paragraph above.

(b) Provide the basis for correlating components to the GALL Report, item VIII.B1, which is for PWRs, when CNS is a BWR plant.

(c) Justify using LRA Note C and LRA Note 305, which appear to be conflicting, for the same item.

In its response to RAI 3.1-3(a), dated July 29, 2009, the applicant stated that the environments of treated water and steam listed in LRA Table 3.3.2-14-2 are not the same as the NUREG-1801 definitions of treated water and steam. The applicant also indicated that footnote 1 to LRA Table 3.0-1 explains the meaning of "treated water" as used in the LRA Table 2 presentation of AMR results. The applicant further indicated that LRA Note 305 is applied in LRA Table 3.3.2-14-2 because the treated water and steam in the AS system are controlled by the Water Chemistry Control - Auxiliary Systems Program, so they are not the same as the NUREG-1801 defined treated water and steam environments, which specify the Water Chemistry Control - BWR Program.

Based on its review, the staff found the response to RAI 3.1-3(a) acceptable because the applicant provided the information requested and explained the subtle difference between the GALL Report and CNS plant-specific environments. Therefore, the concern identified in RAI 3.1-3(a) is resolved.

In its response to RAI 3.1-3(b), dated July 29, 2009, the applicant stated that the comparisons to NUREG-1801, line item VIII.B1-10 will be changed to VIII.B2-5 for the seven lines in LRA Table 3.3.2-14-2. The applicant also indicated that since these two NUREG-1801 line items are otherwise identical, no other changes will be made. The applicant summarized the changes, as shown in Attachment 2 (Change 22), via a transmittal letter to the NRC Document Control Desk, from Stewart B. Minahan, NPPD, dated July 29, 2009 (NLS2009055). The changes are applied to the line items under LRA Table 3.3.2-142-2, on LRA pages 3.3-159 through 3.3-165.

The applicant also indicated that the comparisons to NUREG-1801, line item VIII.B1-10 will also be changed to VIII.B25 for two similar lines in LRA Table 3.3.2-14-11. Additionally, the applicant indicated that LRA Note 305 will be added to these two lines because the steam environment in the HV system is the same as the AS system environment. The applicant summarized the changes via a transmittal letter to the NRC dated July 29, 2009. The changes are applied to the line items under LRA Table 3.3.2-142-11, on LRA pages 3.3-196 and 3.3-197.

Based on its review, the staff found the response to RAI 3.1-3(b) reasonable because the applicant provided the information requested and made the necessary adjustments to the LRA. Therefore, the concern identified in RAI 3.1-3(b) is resolved.

In its response to RAI 3.1-3(c), dated July 29, 2009, the applicant stated that the applicability of the aging effect of cracking due to fatigue in auxiliary systems is dependent on system temperature rather than on the specific chemistry of the environment. The applicant further indicated that according to Note 305, the auxiliary system steam and treated water environments are considered the equivalent of (and thus, consistent with) steam or treated water as defined by NUREG-1801 for the evaluation of cracking due to fatigue. Therefore, the applicant concluded that the AMR results presented in the LRA table line are consistent with those in NUREG-1801, except for the component type, and so LRA Note C is applicable.

Based on its review, the staff found the response to RAI 3.1-3(c) reasonable because the applicant provided the information requested and provided the basis to show that LRA Note C and plant-specific Note 305 are not conflicting. The staff notes that based on the applicant’s response, it seems that Note 305 should be simplified, only to state that for fatigue cracking in auxiliary systems, the environmental effect is insignificant. Nevertheless, the applicant’s explanation as shown is reasonable. Therefore, the concern identified in RAI 3.1-3(c) is resolved.

In addition, 6 of those 47 TLAA items within the auxiliary systems are cited with Note H, which indicates that the aging effect is not addressed in the GALL Report for the indicated component-material-environment combination.

The staff verified that in LRA Section 4.3, the applicant provided its TLAA evaluation for these components. The staff’s evaluation of these TLAAs is documented in SER Section 4.3.2.

Based on 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 functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.2.2 Reduction of Heat Transfer Due to Fouling

LRA Section 3.3.2.2.2 addresses the reduction of heat transfer due to fouling for stainless steel heat exchanger tubes exposed to treated water. The applicant indicated that there are no stainless steel heat exchanger tubes with an intended function of heat transfer exposed to treated water in the auxiliary systems, and that this item was not used.

Based on its review of LRA Tables 3.3.2-1 through 3.3.2-13 and Tables 3.3.2-14-1 through 3.3.2-14-29, the staff confirmed that CNS has no components with the associated SRP-LR related item, and determined that this item is not applicable.

3.3.2.2.3 Cracking Due to Stress-Corrosion Cracking

LRA Section 3.3.2.2.3, item 1 addresses cracking due to SCC in the BWR SLC system. The applicant indicated that this aging effect is not applicable because the normal operating temperature is below 140 °F during normal plant operation.

LRA Section 3.3.2.2.3 addresses cracking due to SCC in the SLC system. The applicant indicated that cracking due to SCC can occur in the stainless steel piping, piping components, and piping elements of the SLC system that are exposed to sodium pentaborate solution at a temperature greater than 140 °F. The applicant also indicated that as the sodium pentaborate solution in the SLC system does not exceed 140 °F at CNS, cracking due to SCC is not an aging effect for the SLC system.

The staff reviewed LRA Section 3.3.2.2.3 against the criteria in SRP-LR Section 3.3.2.2.3, which indicates that cracking due to SCC could occur in the stainless steel piping, piping components, and piping elements of the BWR SLC system that are exposed to a sodium pentaborate solution greater than 60 °C (greater than 140 °F). In its review and comparison, the staff confirmed that the applicant's statement on the temperature range for SCC further evaluation (greater than 140 °F) was adequate, in accordance with the relevant SRP-LR section. The staff also reviewed LRA Table 3.3.1, item 3.3.1-4, in comparison with SRP-LR Table 3.3-1, item 4 and GALL Report, Volume 1, Table 3, item 4. The review and comparison of the items confirmed that the applicant's AMR results in the LRA were adequate in accordance with the guidance documents. Therefore, the staff finds that the applicant's statement that cracking due to SCC is not an aging effect for the SLC system is acceptable and no further evaluation is required for this item because the temperature of the sodium pentaborate solution does not exceed 140 °F.

LRA Section 3.3.2.2.3, item 2 addresses cracking due to SCC in stainless steel heat exchanger components exposed to treated water greater than 140 °F. The applicant indicated that this aging effect is managed by the Water Chemistry Control – BWR Program, and that the One-Time Inspection Program will confirm the effectiveness of the Water Chemistry Control – BWR Program by visually inspecting a representative sample of components crediting this program.

SRP-LR Section 3.3.2.2.3, item 2 indicates that cracking due to SCC may occur in stainless steel and stainless clad steel heat exchanger components exposed to treated water greater than 140 °F. The GALL Report recommends further evaluation of a plant-specific AMP to ensure this aging effect is adequately managed.

The staff evaluated the applicant's Water Chemistry Control – BWR Program and One-Time Inspection Program in SER Sections 3.0.3 and determined that both programs were acceptable. The staff determined that the Water Chemistry Control – BWR Program was consistent with the program elements of GALL AMP XI.M2. The staff also noted that the program relies on monitoring and controlling water chemistry to minimize the potential for cracking by limiting the levels of contaminants in the RCS and by reducing DO through hydrogen and NMCA. The staff also verified that the applicant will use its One-Time Inspection Program to verify the effectiveness of the Water Chemistry Control - BWR Program, which will include a one-time inspection of selected components at susceptible locations, to ensure no significant cracking is occurring in ESF systems. The staff finds the applicant's use of the Water Chemistry Control - BWR Program, combined with the One-Time Inspection Program, is capable of managing this aging effect, and is acceptable because it satisfies the criteria of SRP-LR, Appendix A.1.

Based on its review, the staff concludes that the applicant's programs meet the criteria in SRP-LR, Section 3.3.2.2.3, item 2. For those line items that apply to LRA Section 3.3.2.2.3, item 2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

LRA Section 3.3.2.2.3, item 3 addresses cracking due to SCC in diesel engine exhaust piping, piping components, and piping elements. The applicant indicated that this aging effect is not applicable because these components are not subject to significant moisture accumulation that would allow SCC to occur.

SRP-LR Section 3.3.2.2.3, item 3 indicates that cracking due to SCC may occur in stainless steel 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 the aging effect is adequately managed.

In AMR item AP-33 in Table II.A of NUREG-1833, "Technical Bases for Revision to the License Renewal Guidance Documents," the staff provides the following basis on why it is important to identify cracking due to SCC as an AERM for the internal surfaces of stainless steel emergency DG exhaust piping that are exposed to diesel exhaust (i.e., combusted diesel fuel).

> Similar components constructed of stainless steel were observed to be susceptible to cracking in hot diesel exhaust gas. A plant-specific aging management program will be evaluated to provide reasonable assurance that the component's intended functions will be maintained within the CLB for the period of extended operation.

The diesel exhaust that results from operations of emergency DGs is made up mostly of CO_2 and water in the vapor state. However, there may be some amount of liquid state water (moisture) in the exhaust. Diesel exhaust may also contain some contaminants because the oil fractions that make up the diesel fuel prior to combustion may contain small percentages of N_2, sulfur, or halogen atomic elements impurities. Thus, the staff noted that its basis in NUREG-1833 differed from the applicant's basis because NUREG-1833 supports the staff's basis that diesel exhaust could contain enough moisture and contaminants such as sulfates and chlorides, which would lead to SCC in the internal stainless steel emergency DG exhaust piping surfaces that are exposed to the diesel exhaust environment. Thus, based on a comparison of the applicant's position against the relevant information in NUREG-1833, the staff took the position that the applicant had not taken a conservative position relative to aging management of cracking due to SCC in the internal surfaces of stainless steel emergency DG exhaust piping that are exposed to diesel exhaust. Therefore, in RAI 3.3.2.2.3.3-1, dated June 8, 2009, the staff requested that the applicant provide additional information on the absence of this MEAP combination.

In its response dated June 22, 2009, the applicant stated that it would amend the LRA to identify cracking as an applicable aging effect for the internal stainless steel DG exhaust piping, piping component, and piping element surfaces that are exposed to the diesel exhaust environment and that the PSPM Program will be credited to manage cracking in the internal component surfaces that are exposed to diesel exhaust. The staff verified that the applicant's June 22, 2009 letter made the appropriate changes to the AMRs for the stainless steel emergency DG exhaust piping to credit the PSPM Program for the management of cracking in the internal stainless steel DG exhaust piping, piping components, and piping element surfaces that are exposed to diesel exhaust. The staff also verified that, the applicant amended the PSPM Program to add these components to the scope of the AMP. Therefore, based on this assessment, the staff finds that the applicant has provided an acceptable basis for crediting the PSPM Program for aging management of cracking because: (1) the emergency DGs are only periodically operated in accordance with plant technical specifications or transient operating procedures, (2) the applicant's basis is consistent with criteria in GALL AMP XI.M32 on when one-time inspection programs can be credited for aging management, and (3) the applicant's PSPM Program includes volumetric examination methods and VT-1 or enhanced VT-1 visual inspection methods, which are valid techniques for the detection of cracking in the stainless steel components. Based on the justification and clarification provided, the staff found the applicant's response to be acceptable

3.3.2.2.4 Cracking Due to Stress-Corrosion Cracking and Cyclic Loading – For PWR only, not applicable for CNS

3.3.2.2.5 Hardening and Loss of Strength Due to Elastomer Degradation

For LRA Section 3.3.2.2.5, items 1 and 2, the applicant indicated that CNS will implement the PSPM Program to manage cracking and change in material properties due to elastomer degradation in elastomer flexible connections of auxiliary systems and other systems exposed to air-indoor. This program 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 also indicated that no credit is taken for any elastomer linings to prevent loss of material from the underlying carbon steel material for auxiliary systems. The material is identified as carbon steel for the AMR and this item was not used.

The staff reviewed LRA Section 3.3.2.2.5 against the criteria in SRP-LR Section 3.3.2.2.5, which indicates that hardening and loss of strength due to elastomer degradation may occur in elastomeric seals and components associated with auxiliary HV systems that are exposed either internally or externally to uncontrolled indoor air. The SRP-LR recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

The staff reviewed the PSPM Program in LRA Section B.1.31 and finds the program to be acceptable in identifying resiliency and cracking in elastomeric components. For the HVAC systems, the applicant's PSPM Program will include:

(1) Visually inspect both internally and externally and flex to the extent possible a representative sample of flexible duct connections composed of elastomer.

(2) Visually inspect both internally and externally the portable blower fan housings that are in storage that may be used for ventilation for loss of material.

(3) Visually inspect the HVAC flexible trunks that are in storage that may be used for ventilation for cracking and change in material properties.

(4) Perform visual or other NDE to inspect a representative sample of fan coil unit tubes, fins, and drip pan to manage loss of material and fouling.

The staff finds that the PSPM Program will identify any hardening and loss of strength of elastomers due to degradation. The staff finds that the NDEs and physical manipulations of flexible hosing described in the PSPM Program will identify aging and cracking while performing an inspection.

Based on its review, 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, in accordance with 10 CFR 54.21(a)(3).

3.3.2.2.6 Reduction of Neutron-Absorbing Capacity and Loss of Material Due to General Corrosion

LRA Section 3.3.2.2.6 addresses loss of material due to general corrosion in the neutron-absorbing Boral spent fuel storage racks exposed to treated or borated water as an aging effect requiring management. The loss of material from Boral in the spent fuel pool is managed by the Neutron Absorber Monitoring and Water Chemistry Control – BWR Programs. The Neutron Absorber Monitoring Program has representative Boral coupons mounted in a surveillance assembly placed in the spent fuel pool. The assembly has four sides and is open to the spent fuel pool water, fully exposing the coupons to the water. The surveillance frequency for the assembly is once every eight years. During the surveillance inspection, the coupons are dried, weighed, visually inspected, and photographed. In the LRA, the licensee states that control coupons are inspected concurrently with the coupons removed from the surveillance assembly. The comparison of the control coupons and coupons removed from the spent fuel pool provides the acceptance criteria to determine the need for corrective action.

In LRA Section 3.3.2.2.6, the applicant states that the reduction in neutron-absorbing capacity for the Boral in the spent fuel pool is insignificant and requires no aging management. As a result, Section B.1.23 states that the Boral coupons are no longer evaluated for changes in material properties.

The staff reviewed LRA Section 3.3.2.2.6 against the staff's recommended regulatory criteria in SRP-LR Section 3.3.2.2.6 and in VII.A2-5 of the GALL Report, Volume 2. 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 boiling water reactor and pressurized water reactor spent fuel storage racks exposed to treated water or treated borated water. The GALL Report recommends further evaluation of a plant specific aging management program to ensure that these aging effects are adequately managed.

During the site audit and in RAIs 3.3.2.2.6-1 and 3.3.2.2.6-2 dated June 29, 2009, and July 14, 2009, respectively, the staff requested that the applicant provide additional details on neutron-absorbing materials in the spent fuel pool, the inspection of Boral and Metamic™ coupons, the applicable aging management programs, and operating experience.

The applicant responded to the RAI 3.3.2.2.6-1 in a letter dated July 29, 2009. In the response to the RAI, the applicant also provided information on relevant industry and operating experience. The applicant addressed staff concerns regarding scheduling of inspections and neutron attenuation testing of Boral coupons. The applicant confirmed that the surveillance inspections of the Boral coupons will be performed every eight years. In addition, the applicant stated that the rationale to not evaluate the change in neutron absorbing capacity was due to operating experience from neutron attenuation testing of coupons conducted in 1982 and 1992. The testing indicated no loss of neutron attenuation properties.

The applicant responded to the RAI 3.3.2.2.6-2 in a letter dated August 13, 2009. In response to the RAIs, the applicant provided information on relevant industry operating experience. The applicant also addressed staff concerns regarding performing an aging management review for Metamic™ and including the review in LRA Section 3.3.2.2.6. The applicant stated that qualification testing indicates no change in neutron attenuation characteristics of Metamic™ coupons that undergo accelerated radiation test conditions. As a result of the qualification testing, the applicant stated that reduction of neutron absorption capability is not an aging effect requiring management for the Metamic™ panels in CNS. In addition, the applicant cited NUREG-1787, "Safety Evaluation Report Related to the License Renewal of the Virgil C. Summer Nuclear Station," March 2004, and BNL-NUREG-25582, "Corrosion Considerations in the Use of Boral in Spent Fuel Storage Pool Racks," January 1979, as rationale for determining that reduction of neutron absorption capability is not an aging effect requiring management for the Metamic™ panels. In the RAI response letter, the applicant revised the LRA Section 3.3.2.2.6 to address loss of material due to general corrosion in the neutron-absorbing Metamic™ spent fuel storage racks exposed to treated or borated water as an aging effect requiring management. Furthermore, the applicant states that significant reduction in neutron-absorbing capacity for the Metamic™ in the spent fuel pool is not expected.

After reviewing the applicant's response to the RAIs, the staff determined that more information was needed to accept the justification that there is insignificant change in neutron absorbing capacity of Boral and Metamic™ in the spent fuel pool and that there is no need for further neutron attenuation testing. In addition, the staff has determined that NUREG-1787, "Safety Evaluation Report Related to the License Renewal of the Virgil C. Summer Nuclear Station," March 2004, and BNL-NUREG-25582, "Corrosion Considerations in the Use of Boral in Spent Fuel Storage Pool Racks," January 1979, do not justify the conclusion that neutron absorption degradation is not an aging effect requiring management. As a result, the staff and the license held a teleconference on September 21, 2009, to clarify the responses to the RAIs; subsequently, the staff issued additional RAIs 3.3.2.2.6-3 and 3.3.2.2.6-4 dated October 29, 2009. In the RAIs, the staff requested that the applicant provide additional details on the frequency of surveillance inspections, results of the last evaluation for Boron-10 areal density measurements, neutron attenuation of Metamic™ coupons, and results from past coupon testing.

In its response dated November 30, 2009, the applicant stated that the frequency for surveillance inspections during the period of extended operation will occur every eight years and that monitoring of the water chemistry parameters will be conducted in accordance with EPRI water chemistry guidelines published in EPRI Report 1008192 (BWRVIP-130). In addition, the applicant provided a discussion on the tests results of coupons that were identified with swelling. The applicant stated that the coupons that were identified with swelling did not exhibit any reduction in neutron attenuation performance and that they are not characteristic of swollen Boral panels in the spent fuel pool. In addition, the applicant stated that the Metamic™ coupon sampling program will continue to periodically test and monitor neutron attenuation performance of Metamic™ coupons in accordance with License Amendment 227 during the period of extended operation. After reviewing the applicant's response to the RAIs, the staff and the applicant held a telephone conference call on January 8, 2010, to discuss clarifications for certain responses to the RAIs in detail. On the call the applicant indicated that it would agree to perform neutron attenuation testing on the Boral sample coupons as a mean to monitor for neutron absorber degradation. The applicant stated that an enhancement would be made to the Neutron Absorber Monitoring Program to include neutron attenuation testing of representative sample coupons. It further stated that neutron attenuation testing would be performed at least once every 10 years during the period of extended operation, to verify that there is no loss of neutron absorbing capacity of the Boral material. In addition, the applicant also indicated that it would agree to perform neutron attenuation testing prior to the period of extended operation as a baseline inspection to determine the degree of neutron attenuation. The staff finds such proposal for the performance of neutron attenuation testing acceptable because it is an adequate means to monitor neutron absorber degradation, which is an AERM. By letter dated March 29, 2010, the applicant submitted Commitment No. NLS2010019-02 to supplement the Neutron Absorber Monitoring Program to include neutron attenuation testing of representative sample coupons.

Based on its review, the staff concludes that the applicant's aging effect management of the reduction of neutron-absorbing capacity and the loss of material meets SRP-LR Section 3.3.2.2.6 criterion. 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, in accordance with 10 CFR 54.21(a)(3).

3.3.2.2.7 Loss of Material Due to General, Pitting, and Crevice Corrosion

LRA Section 3.3.2.2.7, item 1 addresses loss of material due to general, pitting, and crevice corrosion that may occur in piping, piping components, and piping elements. The applicant indicated that loss of material for steel components exposed to lubricating oil is managed by the Oil Analysis Program. The Oil Analysis Program manages aging effects through periodic monitoring and control of contaminants, thus preserving an environment that is not conducive to corrosion. The applicant also indicated that the One-Time Inspection Program will provide a verification of the effectiveness of the Oil Analysis Program to manage loss of material due to general, pitting, and crevice corrosion through examination of steel components. The applicant further indicated that CNS is a BWR with an inert containment atmosphere and thus does not have a reactor coolant pump oil collection system.

SRP-LR Section 3.3.2.2.7, item 1 indicates that loss of material due to general, pitting, and crevice corrosion may occur in steel piping, piping components, and piping elements including tubing, valves, and tanks in the reactor coolant pump oil collection system, exposed to lubricating oil. The existing program periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always 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 programs. 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.

Furthermore, SRP-LR 3.3.2.2.7, item 1 indicates that corrosion may occur at locations in the reactor coolant pump oil collection tank where water from wash downs may accumulate. The GALL Report recommends further evaluation to verify the effectiveness of the lubricating oil programs. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the applicant's Oil Analysis Program and One-Time Inspection Program and its evaluations are documented in SER Section 3.0.3. The staff determined that the Oil Analysis Program includes periodic sampling and analysis of lubricating oil to determine if contaminants, particulates, and water are present. The staff noted that the presence of these impurities in the lubricating oil can create an environment that is conducive to age-related degradation such as loss of material, cracking, and fouling. The staff determined that the activities performed as part of this program will be capable of preserving an environment that will not promote loss of material, cracking, and fouling. The staff finds that these activities are consistent with the recommendations in the GALL Report and are adequate to manage general, pitting, and crevice corrosion and fouling in steel piping, piping components, and piping elements exposed to lubricating oil. The staff verified that the applicant has credited its One-Time Inspection Program, which includes a one-time inspection of selected components at susceptible locations, to verify the effectiveness of the Oil Analysis Program to manage this aging effect. On the basis that the applicant's AMPs are consistent with those recommended in SRP-LR Section 3.3.2.2.7, item 1, the staff finds the applicant's use of the Oil Analysis Program and One-Time Inspection Program acceptable.

Based on its review, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.7, item 1 criteria. For those line items that apply to LRA Section 3.3.2.2.7, item 1, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

The staff notes that LRA Table 3.3.1, items 3.3.1-15 and 3.3.1-16 are not applicable to CNS, which align to the GALL Report, items VII.G-26 and VII.G-27. The applicant indicated that CNS is a BWR with an inert containment atmosphere and thus does not have a reactor coolant pump oil collection system. The staff confirmed that CNS is a BWR with an inert containment atmosphere and reviewed 10 CFR Part 50 Appendix R Section III.O, and noted that CNS is not required to have an oil collection system for the reactor coolant pump. Therefore, aging of the piping, tubing, valve bodies, and tanks in the reactor coolant pump oil collection system are not applicable to CNS. Thus, the staff finds the applicant's conclusion that the aging effect loss of material due to general, pitting, and crevice corrosion for tubing, valves, and tanks in the reactor coolant pump oil collection system exposed to lubricating oil is not applicable to CNS to be acceptable and GALL Report, items VII.G-26 and VII.G-27 do not apply.

LRA Section 3.3.2.2.7, item 2 and LRA Table 3.3.2-14-24 address the loss of material due to general, pitting, and crevice corrosion of the carbon piping in the RWCU system exposed to treated water. In LRA Table 3.3.2-14-24, the applicant proposed to manage this aging process for this component exposed to this environment through the use of its Water Chemistry Control – BWR and One-Time Inspection programs under GALL Report, item VII.E3-18. The applicant indicated that for the component, material, and environment combination listed, the component is consistent with the GALL Report item for component, material, environment, and aging effect, and the applicant's AMP is consistent with the GALL Report.

SRP-LR Section 3.3.2.2.7, item 2 indicates 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 in crevices and with stagnant flow conditions may cause general, pitting, or crevice corrosion; 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 manage loss of material from general, pitting, and crevice corrosion to verify the effectiveness of the Water 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 applicant's Water Chemistry Control – BWR Program in SER Section 3.0.3 and verified that it is consistent with GALL AMP XI.M2. The staff also reviewed the applicant's One-Time Inspection Program in SER Section 3.0.3 and verified that it is consistent with GALL AMP XI.M32. The staff further verified that the component, material, and environment combination identified by the applicant is consistent with that listed in the GALL Report, item VII.E3-18 for component, material, environment, and aging effect. The staff, therefore, finds the applicant's management of loss of material due to general, pitting, and crevice corrosion acceptable because the applicant satisfied the acceptance criteria in SRP-LR Section 3.3.2.2.7, item 2 and the applicant's programs are consistent with the ones under GALL Report, item VII.E3-18.

Based on its review, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.7, item 2 criteria. For those line items that apply to LRA Section 3.3.2.2.7, item 2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

LRA Section 3.3.2.2.7, item 3 addresses loss of material due to general, pitting, and crevice corrosion in diesel exhaust piping, piping components, and piping elements. The applicant indicated that loss of material due to general corrosion for carbon steel and stainless steel piping components in the emergency DG system exposed to diesel exhaust is managed by the PSPM Program. The staff's evaluation of this program is documented in SER Section 3.0.3. Additionally, the carbon steel diesel exhaust piping and components in the fire protection system are managed by the Fire Protection Program. The staff's evaluation of this program is documented in SER Section 3.0.3.

SRP-LR Section 3.3.2.2.7 indicates that loss of material due to general (steel only), pitting, and crevice corrosion may occur in steel and stainless steel 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 the aging effect is adequately managed.

SRP-LR Section 3.3.2.2.7, item 3 references AMR item 18 in Table 3 of the GALL Report, Volume 1 and AMR item VII.H2-2 in Table VII.H2 of the GALL Report, Volume 2 as the applicable AMRs for evaluating loss of material due to general, pitting, and crevice corrosion in steel and stainless steel DG piping, piping components, and piping elements that are exposed to a diesel exhaust environment. The aging management guidance in these AMRs for DG exhaust piping is consistent with that given in SRP-LR Section 3.3.2.2.7, item 3.

The staff noted that the applicant's AMR items on loss of material in emergency DG exhaust piping components are given in LRA Table 3.3.2-4, "Diesel Generator System" and in LRA Table 3.3.2-6, "Fire Protection- Water System." The staff confirmed that LRA Tables 3.3.2-4 and 3.3.2-6 did include AMRs for managing loss of material in internal steel DG piping, piping components, and piping elements surfaces that are exposed to an exhaust gas environment and that these AMRs were referenced to GALL AMR VII.H2-2. The staff also confirmed that in these AMRs, the applicant credited its PSPM Program and Fire Protection Program, to manage loss of material in the internal steel DG exhaust piping, piping components, and piping element surfaces that are exposed to an exhaust gas environment.

The staff noted that the applicant's PSPM Program is a plant-specific AMP which specifically identifies the DG system for aging management inspections. As part of this AMP, the applicant specifies the visual inspection of a representative sample of DG exhaust gas components to manage loss of material. The applicant's AMP also clarifies that the actual representative sample size is based on Chapter 4 of EPRI document 107514, "Age-Related Degradation Inspection Method and Demonstration," which outlines a method to determine the sample size required to achieve 90 percent confidence that 90 percent of the population does not experience degradation. Furthermore, the applicant indicated that components with the same material-environment combinations at other facilities may be included in the sample. The staff noted that the applicant was not clear in the exact sample size to be inspected for the limited population of DG exhaust components managed by the AMR line items specified, and also noted that the applicant was not clear on how it intended to apply the results of inspections at other facilities. Therefore, in RAI 3.3.2.2.7.3-1, dated June 8, 2009, the staff requested that the applicant provide additional information on clarifying the representative sample indicated in the LRA.

In its response dated June 22, 2009, the applicant stated that the total population of DG exhaust components is eight, of which seven will be sampled for inspection. Furthermore, the applicant clarified that its original statement in the LRA claiming the use of samples from other facilities is to be removed, and therefore confusion regarding the sampling of these components is resolved. Based on the justification and clarification provided, the staff found the applicant's response to be acceptable.

The staff also noted that the applicant's Fire Protection Program manages loss of material from the fire protection system carbon steel diesel exhaust piping and components through visual inspections conducted at least once every five years. In order to inspect for aging effects caused by exhaust gas, it is necessary for the program to inspect the internal surface of the exhaust components. The applicant's Fire Protection Program was not clear in whether or not the internal surface was included in the inspections. Therefore, in RAI 3.3.2.2.7.3-2, dated June 8, 2009, the staff requested that the applicant provide additional information on clarifying the nature of the inspection.

In its response dated June 22, 2009, the applicant stated that the inspection of carbon steel diesel exhaust piping and components is intended and planned to be for the internal surface of the exhaust components. The staff notes that the internal surface of diesel exhaust components should be inspected at least once every five years in order to ensure proper management of the cracking due to the loss of material due to general, pitting, and crevice corrosion aging effect. Based on the justification and clarification provided, the staff found the applicant's response to be acceptable.

The staff confirmed that the PSPM and the Fire Protection programs will adequately manage the loss of material due to general (steel only) pitting and crevice corrosion for carbon steel and stainless steel diesel exhaust piping and components exposed to diesel exhaust. Specifically, loss of material for stainless steel components exposed to exhaust gas of the emergency DG systems is managed by periodic visual inspections performed under the PSPM Program. Loss of material in carbon steel diesel exhaust piping and components of the diesel fire pump engine is managed by the Fire Protection Program which includes visual inspections of the diesel exhaust piping and components.

The staff verified that the PSPM and the Fire Protection programs will manage the loss of material so that the intended functions of the emergency DG systems and diesel fire pump engine will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.2.8 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

LRA Section 3.3.2.2.8 addresses loss of material due to general, pitting, crevice, and MIC for carbon steel (with or without coating or wrapping) piping and components buried in soil in the auxiliary systems. The applicant indicated that it will manage this aging through the use of its Buried Piping and Tanks Inspection Program (reviewed in SER Section 3.0.3). The applicant indicated that 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. The applicant also indicates that buried components will be inspected when excavated during maintenance. The applicant further indicates that an inspection will be performed within 10 years of entering the period of extended operation, unless an opportunistic inspection occurred within this 10-year period. This program will manage the aging effect of loss of material so that the intended function of the components will not be affected.

The staff reviewed LRA Section 3.3.2.2.8 against the criteria in SRP-LR Section 3.3.2.2.8 which indicates that loss of material due to general, pitting, crevice, and MIC could occur for steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil. The GALL Report indicates that the Buried Piping and Tanks Inspection Program relies on industry practice, frequency of pipe excavation, and OE to manage the effects of loss of material from general, pitting, crevice, and MIC. The GALL Report also indicates that the effectiveness of the Buried Piping and Tanks Inspection Program should be verified to evaluate an applicant's inspection frequency and OE with buried components, ensuring that loss of material is not occurring.

The staff also reviewed AMR items subordinate to LRA Table 3.3.1, item 3.3.1-19, which is associated with LRA Section 3.3.2.2.8. In this review, the staff noted that the applicant proposes that the components associated with item 3.3.1-19 are either fully consistent with the GALL Report or are consistent with the GALL Report in all respects except the component is different.

In its review of components subordinate to LRA item 3.3.1-19, the staff concurs with the applicant that these items are, in fact, consistent with the GALL Report. As described in SRP-LR Section 3.0.1, items which are consistent with the GALL Report are acceptable for license renewal.

In its review of components subordinate to LRA item 3.3.1-19, the staff noted that the components listed do not meet the precise definition of the GALL Report. However, the staff also noted that the corrosion mechanisms and rates expected in these components are similar to those expected for the components listed in the GALL Report and that the same AMP could be effectively employed. The staff accepts that the components under consideration are sufficiently similar to those actually included in SRP-LR Table 3.3.1, ID 19 so as not to render them inconsistent with the GALL Report. As described in SRP-LR Section 3.0.1, items which are consistent with the GALL Report are acceptable for license renewal.

Based on its review, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.8 criteria. 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 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, in accordance with 10 CFR 54.21(a)(3).

3.3.2.2.9 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion and Fouling

LRA Section 3.3.2.2.9, item 1 addresses loss of material due to general, pitting, crevice, and MIC and fouling in steel piping, piping components, and piping elements exposed to fuel oil. The applicant indicated that loss of material due to general, pitting, crevice, and MIC for steel piping components and tanks exposed to fuel oil is managed by the Diesel Fuel Monitoring Program, which includes periodic monitoring and control of contaminants. The One-Time Inspection Program will provide a verification of the effectiveness of the Diesel Fuel Monitoring Program to manage loss of material due to general, pitting, crevice, and MIC through examination of steel piping components and tanks exposed to fuel oil.

The staff reviewed LRA Section 3.3.2.2.9, item 1 against the criteria in SRP-LR Section 3.3.2.2.9 which indicates that loss of material due to general, pitting, crevice, and MIC and fouling may occur in steel piping, piping components, piping elements, and tanks exposed to fuel oil. The existing Diesel Fuel Monitoring Program relies on 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. SRP-LR Section 3.3.2.2.9 recommends that the effectiveness of the AMP should be verified to ensure that corrosion is not occurring. SRP-LR Section 3.3.2.2.9 indicates that the GALL Report recommends further evaluation of programs to manage loss of material due to general, pitting, crevice, and MIC and fouling to verify the effectiveness of the AMP. SRP-LR Section 3.3.2.2.9 indicates that a one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component intended functions will be maintained during the period of extended operation.

The staff reviewed the applicant's Diesel Fuel Monitoring Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3, found that the Diesel Fuel Monitoring Program provides aging management for loss of material through monitoring and control of fuel oil contamination, such as water or microbiological organisms. The staff also reviewed the applicant's One-Time Inspection Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3, found that the One-Time Inspection Program is a one-time inspection that is consistent with the GALL Report's recommendations for AMP XI.M32, "One-Time Inspection." The staff determined the One-Time Inspection Program includes provisions for inspecting selected components so there will be 90 percent confidence that 90 percent of the population does not experience degradation and is capable of detecting loss of material due to general, pitting, crevice, and MIC and fouling, if it should occur in the selected components. The staff noted that the One-Time Inspection Program includes provisions for increasing the inspection sample size and locations if degradation has been detected. Based on the applicant's use of a one-time inspection consistent with the recommendations of the GALL Report, the staff finds the applicant's proposed AMPs for managing the potential aging effect of loss of material due to general, pitting, crevice, and MIC for steel piping, piping components, piping elements, and tanks exposed to fuel oil in the fuel oil system and in the diesel generator fuel oil (DGFO) system to be acceptable.

Based on its review, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.9 criteria. For those line items that apply to LRA Section 3.3.2.2.9, item 1, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

LRA Section 3.3.2.2.9, item 2 addresses loss of material due to general, pitting, crevice, and MIC that may occur in heat exchanger components. The applicant indicated that loss of material for carbon steel components exposed to lubricating oil is managed by the Oil Analysis Program. The Oil Analysis Program manages aging effects through periodic monitoring and control of contaminants, thus preserving an environment that is not conducive to corrosion. The applicant further indicated that the One-Time Inspection Program will provide a verification of the effectiveness of the Oil Analysis Program to manage loss of material due to general, pitting, crevice, and MIC through examination of carbon steel components.

SRP-LR Section 3.3.2.2.9 indicates that loss of material due to general, pitting, crevice, and MIC and fouling may occur in steel heat exchanger components exposed to lubricating oil. The existing program periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lubricating 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 programs. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the applicant's Oil Analysis Program and One-Time Inspection Program and its evaluations are documented in SER Section 3.0.3. The staff determined that the Oil Analysis Program includes periodic sampling and analysis of lubricating oil to determine if contaminants, particulates, and water are present. The staff noted that the presence of these impurities in the lubricating oil can create an environment that is conducive to age-related degradation such as loss of material, cracking, and fouling. The staff determined that the activities performed as part of this program will be capable of preserving an environment that will not promote loss of material, cracking, and fouling. The staff finds that these activities are consistent with the recommendations in the GALL Report and are adequate to manage general, pitting, crevice, and MIC and fouling in steel heat exchanger components exposed to lubricating oil. The staff verified that the applicant has credited its One-Time Inspection Program, which includes a one-time inspection of selected components at susceptible locations, to verify the effectiveness of the Oil Analysis Program to manage this aging effect. On the basis that the applicant's AMPs are consistent with those recommended in SRP-LR Section 3.3.2.2.9, the staff finds the applicant's use of the Oil Analysis Program and One-Time Inspection Program acceptable.

Based on its review, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.9 criteria. For those line items that apply to LRA Section 3.3.2.2.9, item 2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.2.10 Loss of Material Due to Pitting and Crevice Corrosion

LRA Section 3.3.2.2.10, item 1 addresses loss of material due to pitting and crevice corrosion which could occur in steel piping with elastomer lining or stainless steel cladding that is exposed to treated water and treated borated water if the cladding or lining is degraded. The applicant stated that for its auxiliary systems, no credit is taken for elastomer linings or stainless steel cladding to prevent loss of material from the underlying carbon steel material when exposed to treated water; the material is identified as carbon steel for the AMR. The applicant also stated that the Water Chemistry Control – BWR Program (LRA B.1.39) (reviewed in SER section 3.0.3) manages loss of material in steel components exposed to treated water. The applicant further stated that the effectiveness of the program will be confirmed by the One-Time Inspection Program (LRA B.1.29) (reviewed in SER section 3.0.3).

The staff reviewed LRA section 3.3.2.2.10, item 1 against the criteria in SRP-LR section 3.3.2.2.10, item 1 which states that loss of material due to pitting and crevice corrosion could occur in BWR and PWR steel piping with elastomer lining or stainless steel cladding that are exposed to treated water and treated borated water if the cladding or lining is degraded. The existing AMP relies on monitoring and control of reactor water chemistry to manage the aging effects of loss of material from pitting and crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause pitting or crevice corrosion. Therefore, the effectiveness of the Water Chemistry Control Program (GALL AMP XI.M2) should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material from pitting and crevice corrosion to verify the effectiveness of the Water Chemistry Program. A One-Time Inspection (GALL AMP XI.M32) of select components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In its review of LRA Section 3.3.2.2.10, item 1 the staff also reviewed items subordinate to LRA Table 3.3.1, item 3.3.1-22, which are associated with this LRA section and noted that there were no subordinate items to this LRA table which is consistent with the applicant's assertion that linings or claddings are not credited for aging management and that, for the purposes of aging management, these components are treated as though they are bare carbon steel. The staff also noted that while the SRP-LR item (Table 3.3-1 ID 22 which corresponds to this LRA item (3.3.1-22) states that it is for BWRs and PWRs, it is only used in the GALL Report for treated borated water (i.e., for PWRs). The staff further noted that the GALL Report contains references to bare carbon steel exposed to treated water. In these cases the recommended AMPs are identical to those proposed for this LRA item (i.e., Water Chemistry and One Time Inspection programs). Based on this analysis, the staff accepts the applicant's proposal that these components be managed for aging as if they were bare steel because this component and environment combination is present in the GALL Report and the recommended aging management programs are identical to the ones recommended if linings or cladding are present.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.10, item 1 criteria. For those line items that apply to LRA Section 3.3.2.2.10, item 1, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3).

<u>LRA Section 3.3.2.2.10, item 2</u> addresses loss of material due to pitting and crevice corrosion for stainless steel and aluminum piping and components and for stainless steel heat exchanger components exposed to treated water in the auxiliary systems. The applicant indicated that it will manage this aging through the use of its Water Chemistry Control – BWR Program (reviewed in SER Section 3.0.3). The applicant also indicated that the effectiveness of the program will be confirmed by the One-Time Inspection Program (evaluated in SER Section

3.0.3) through an inspection of a representative sample of components crediting this program, including susceptible locations such as areas of stagnant flow.

The staff reviewed LRA Section 3.3.2.2.10, item 2 against the criteria in SRP-LR Section 3.3.2.2.10 which indicates that loss of material due to pitting and crevice corrosion could occur for stainless steel and aluminum piping, piping components, piping elements, and for stainless steel and steel with stainless steel cladding heat exchanger components exposed to treated water. The GALL Report indicates that the existing AMP (GALL AMP XI.M2, “Water Chemistry”) relies on monitoring and control of reactor water chemistry to manage the aging effects of loss of material from pitting and crevice corrosion. The GALL Report also indicates that high concentrations of impurities at crevices and locations of stagnant flow conditions could cause pitting or crevice corrosion. The GALL Report further indicates that the effectiveness of the Water Chemistry Control Program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material from pitting and crevice corrosion to verify the effectiveness of the Water Chemistry Program. A one-time inspection (GALL AMP XI.M32) of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component’s intended function will be maintained during the period of extended operation.

The staff notes that in LRA Section 3.3.2.2.10, item 2, the applicant has identified appropriate AMPs and has identified the critical conditions requiring further review (i.e., the potential for water chemistry control to be ineffective in stagnant areas). The staff finds that LRA Section 3.3.2.2.10, item 2 is consistent with SRP-LR Section 3.3.2.2.10, item 2.

The staff also reviewed AMR items subordinate to LRA Table 3.3.1, item 3.3.1-23, which is associated with LRA Section 3.3.2.2.10, item 2. In its review, the staff noted that the applicant proposes that the components associated with item 3.3.1-23 are either fully consistent with the GALL Report or are consistent with the GALL Report in all respects except the component is different. In its review, the staff also noted the absence of any heat exchanger components constructed from steel with stainless steel cladding, thereby explaining the omission of this material from the LRA as compared to the SRP.

In its review of components subordinate to LRA item 3.3.1-23, for which the applicant assigned LRA Note A, the staff concurs with the applicant that these items are, in fact, consistent with the GALL Report. As described in SRP-LR Section 3.0.1, items which are consistent with the GALL Report are acceptable for license renewal.

In its review of components subordinate to LRA item 3.3.1-23, the staff noted that the components listed do not meet the precise definition of the GALL Report. However, the staff also noted that the corrosion mechanisms and rates expected in these components are similar to those expected for the components listed in the GALL Report and that the same AMP could be effectively employed. The staff accepts that the components under consideration are sufficiently similar to those actually included in SRP-LR Table 3.3.1, item 23 so as not to render them inconsistent with the GALL Report. As described in SRP-LR Section 3.0.1, items which are consistent with the GALL Report are acceptable for license renewal.

Based on its review, the staff concludes that the applicant’s programs meet SRP-LR Section 3.3.2.2.10, item 2 criteria. For those line items that apply to LRA Section 3.3.2.2.10, item 2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

LRA Section 3.3.2.2.10, item 3 credits the External Surfaces Monitoring Program to manage loss of material due to pitting and crevice corrosion of copper alloy greater than 15 percent Zn or greater than 8 percent Al and copper alloy components in the HV exposed to condensation (external) in the SW system, N_2 system, HV system and the SW systems, nonsafety-related components affecting safety-related system. The applicant further indicated that the External Surfaces Monitoring Program consists of periodic visual inspections.

The staff reviewed LRA Section 3.3.2.2.10 against the criteria in SRP-LR Section 3.3.2.2.10, which indicates that loss of material due to pitting and crevice corrosion may occur in copper alloy HVAC piping, piping components, and piping elements exposed to condensation (external). The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

SRP-LR Section 3.3.2.2.10 corresponds to GALL Report, Volume 1, Table 3, item 25 and AMR items VII.F1-16, VII.F2-14, VII.F3-16, and VII.F4-12 in the GALL Report, Volume 2, as applicable to copper alloy HVAC piping, piping components, and piping elements exposed to condensation (external). The staff confirmed that the applicant referenced GALL Report item VII.F1-16 for the SW system, N_2 system, HV system and the SW systems, nonsafety-related components affecting safety-related system that are only HVAC piping, piping components, and piping elements fabricated of copper alloy that credit the External Surfaces Monitoring Program.

The staff reviewed the applicant's External Surfaces Monitoring Program and its evaluation is documented in SER Section 3.0.3. The staff determined that the External Surfaces Monitoring Program, which includes periodic visual inspections of external surfaces performed during system walkdowns, is adequate to manage loss of material due to pitting and crevice corrosion for copper alloy HVAC piping, piping components, and piping elements exposed to an external condensation environment addressed by this AMR. The staff noted that a visual inspection will be capable of identifying degradation on the external surface that will present itself in signs of corrosion, corrosion byproducts, coating degradation, discoloration on the surface, scale/deposits, and pits and surface discontinuities that are indicative of loss of material. On the basis of periodic visual inspections being performed during system walkdowns of these components by the External Surfaces Monitoring Program, the staff finds the applicant's use of this AMP acceptable.

Based its review, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.10 criteria. For those line items that apply to LRA Section 3.3.2.2.10, item 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 functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

LRA Section 3.3.2.2.10, item 4 addresses loss of material due to pitting and crevice corrosion that may occur in piping, piping components, and piping elements. The applicant indicated that loss of material for copper alloy components exposed to lubricating oil is managed by the Oil Analysis Program. The Oil Analysis Program manages aging effects through periodic monitoring and control of contaminants, thus preserving an environment that is not conducive to corrosion. The applicant further indicated that the One-Time Inspection Program will provide a verification of the effectiveness of the Oil Analysis Program to manage loss of material due to pitting and crevice corrosion through examination of copper alloy components.

SRP-LR Section 3.3.2.2.10 indicates 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 program periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always 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 programs. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the applicant's Oil Analysis Program and One-Time Inspection Program and its evaluations are documented in SER Section 3.0.3. The staff determined that the Oil Analysis Program includes periodic sampling and analysis of lubricating oil to determine if contaminants, particulates, and water are present. The staff noted that the presence of these impurities in the lubricating oil can create an environment that is conducive to age-related degradation such as loss of material, cracking, and fouling. The staff determined that the activities performed as part of this program will be capable of preserving an environment that will not promote loss of material, cracking, and fouling. The staff finds that these activities are consistent with the recommendations in the GALL Report and are adequate to manage loss of material due to pitting and crevice corrosion in copper alloy piping, piping components, and piping elements exposed to lubricating oil. The staff verified that the applicant has credited its One-Time Inspection Program, which includes a one-time inspection of selected components at susceptible locations, to verify the effectiveness of the Oil Analysis Program to manage this aging effect. On the basis that the applicant's AMPs are consistent with those recommended in SRP-LR Section 3.3.2.2.10, the staff finds the applicant's use of the Oil Analysis Program and One-Time Inspection Program acceptable.

Based on its review, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.10 criteria. For those line items that apply to LRA Section 3.3.2.2.10, item 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, in accordance with 10 CFR 54.21(a)(3).

LRA Section 3.3.2.2.10, item 5 addresses loss of material due to pitting and crevice corrosion in stainless steel ducting components exposed to condensation. The applicant indicated that the Bolting Integrity and External Surfaces Monitoring programs will manage loss of material in stainless steel components exposed to condensation and that these programs include periodic visual inspections to manage loss of material of the components.

The staff reviewed LRA Section 3.3.2.2.10, item 5 against the criteria in SRP-LR Section 3.3.2.2.10, which indicates that loss of material due to pitting and crevice corrosion may occur in HVAC aluminum piping, piping components, and piping elements and stainless steel ducting components exposed to condensation. The staff noted that only stainless steel ducting and components are applicable to CNS, because there are no aluminum components that are exposed to condensation in the HV and, therefore, the portion relating to aluminum components will not be discussed in this section of the SER.

SRP-LR Section 3.3.2.2.10 corresponds to item 27 in Table 3 of the GALL Report, Volume 1, and AMR items VII.F1-1, VII.F2-1, VII.F3-1, VII.F1-14, VII.F2-12, VII.F3-14, and VII.F4-10 in the GALL Report, Volume 2, as being applicable to stainless steel HVAC piping, piping components, and piping elements exposed to condensation (external). The staff confirmed that the applicant referenced GALL Report item VII.F1-1 for the SW systems, N_2 system, HV system, REC system and CW system that have only HVAC piping, piping components, and piping elements fabricated of stainless steel that credit the External Surfaces Monitoring Program and the Bolting Integrity Program.

The staff noted that for the HVAC piping, piping components, and piping elements addressed in LRA Section 3.3.2.2.10, item 5, the applicant credited the Bolting Integrity Program specifically for bolting components only. For the remaining HVAC piping, piping components, and piping elements, the applicant credited the External Surfaces Monitoring Program for aging management.

The staff reviewed the applicant's External Surfaces Monitoring Program and its evaluation is documented in SER Section 3.0.3. The staff determined that the External Surfaces Monitoring Program, which includes periodic visual inspections of external surfaces performed during system walkdowns, is adequate to manage loss of material due to pitting and crevice corrosion for stainless steel HVAC piping, piping components, and piping elements exposed to an external condensation environment addressed by this AMR. The staff noted that a visual inspection will be capable of identifying degradation on the external surface that will present itself in signs of corrosion, corrosion byproducts, coating degradation, discoloration on the surface, scale/deposits, and pits and surface discontinuities that are indicative of loss of material. On the basis of periodic visual inspections being performed during system walkdowns of these components by the External Surfaces Monitoring Program, the staff finds the applicant's use of the External Surfaces Monitoring Program acceptable.

The staff reviewed the applicant's Bolting Integrity Program as documented in SER Section 3.0.3. The applicant indicated in the LRA that this program manages cracking, loss of material, and loss of preload. The staff determined that the aging effects are managed through the implementation of procedures which follow NRC approved guidance (NUREG-1339, EPRI NP-5769 and EPRI TR-104213). Additionally, the staff determined that the program includes periodic visual inspections of closure bolting for crack initiation, loss of preload, or loss of material due to corrosion which may result in leakage. The staff noted that a visual inspection will be capable of detecting loss of material for closure bolting which will present itself in signs of corrosion, corrosion byproducts, discoloration on the surface, scale/deposits, leakage and pits, and surface discontinuities that are indicative of loss of material. On the basis of periodic visual inspections being performed by the Bolting Integrity Program, the staff finds the applicant's use of the Bolting Integrity Program acceptable.

Based on its review, the staff concludes that the applicant's program meets SRP-LR Section 3.3.2.2.10 criteria. For those line items that apply to LRA Section 3.3.2.2.10, item 5, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

<u>LRA Section 3.3.2.2.10, item 6</u> addresses loss of material due to pitting and crevice corrosion which could occur for copper alloy fire protection system piping, piping components, and piping elements exposed to internal condensation. The applicant stated that its fire protection systems did not have copper alloy components exposed to condensation. However, the applicant also stated that this section could be applied to copper alloy components exposed to internal condensation in other systems. The applicant further stated that its Periodic Surveillance and

Preventive Maintenance program would be used to manage the loss of material in copper alloy components exposed internally to condensation through the use of periodic visual inspections.

The staff reviewed LRA Section 3.3.2.2.10, item 6 against the criteria in SRP-LR Section 3.3.2.2.10, item 6, which states that loss of material due to pitting and crevice corrosion could occur for copper alloy fire protection system components exposed to internal condensation. The GALL Report recommends further evaluation of a plant-specific AMP to ensure these aging effects are adequately managed.

The staff reviewed the LRA and verified that the applicant did not have copper alloy fire protection piping components and piping elements exposed to internal condensation with the scope of license renewal. However, the staff noted that the applicant listed copper alloy piping components (e.g., valve body and tubing) in other systems (e.g., diesel generator system, service air system, etc.).

The staff reviewed the applicant's Periodic Surveillance and Preventive Maintenance program and its evaluation is documented in SER 3.0.3. The staff determined that the Surveillance and Preventive Maintenance Program, which included periodic internal visual inspections of a representative sample of copper alloy components exposed to raw water (drain water) to manage the loss of material. The staff determined such inspections performed during repetitive tasks or routine monitoring of the plant operations, is adequate to manage loss of material for copper alloy components. The staff noted that material loss or degradation of copper alloy components could be identified via visual inspections of internal surfaces because signs of corrosion or corrosion products were visible and during visual inspections. On the basis of periodic visual inspections performed during the course of routine monitoring of plant operations of these components by the Periodic Surveillance and Preventive Maintenance program, the staff finds the applicant's use of this program acceptable.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.10, item 6 criteria. For those line items that apply to LRA Section 3.3.2.2.10, item 6, the staff determines that the LRA is consistent 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 in accordance with 10 CFR 54.21(a)(3).

<u>LRA Section 3.3.2.2.10, item 7</u> addresses loss of material due to pitting and crevice corrosion which could occur for stainless steel piping, piping components, and piping elements exposed to soil. The applicant indicated that there are no stainless steel piping components exposed to soil in the auxiliary systems. The applicant also indicated that this item was not used.

The staff reviewed LRA Section 3.3.2.2.10, item 7 against the criteria in SRP-LR Section 3.3.2.2.10, which indicates that loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements exposed to soil. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed. The GALL Report indicates that acceptance criteria are described in BTP RLSB-1 (Appendix A.1 of this SRP-LR).

In its review of LRA Section 3.3.2.2.10, item 7, the staff also reviewed items subordinate to LRA Table 3.3.1, item 29 which is associated with this LRA section. In its review, the staff noted that answers to staff inquires during the AMP audit indicated no buried stainless steel piping was present. The staff also noted that a search of the applicant's USAR (auxiliary system) for "stainless steel" failed to find any evidence that such piping existed.

The staff concludes that the components addressed by this AMR item do not exist and that this item is not applicable.

LRA Section 3.3.2.2.10, item 8 addresses loss of material due to pitting and crevice corrosion for stainless steel piping and components of the SLC system exposed to sodium pentaborate solution. The applicant indicated that it will manage this aging through the use of its Water Chemistry Control – BWR Program (reviewed in SER Section 3.0.3). The effectiveness of the Water Chemistry Control – BWR Program will be confirmed by the One-Time Inspection Program (reviewed in SER Section 3.0.3) through an inspection of a representative sample of components crediting this program, including susceptible locations such as areas of stagnant flow.

The staff reviewed LRA Section 3.3.2.2.10, item 8 against the criteria in SRP-LR Section 3.3.2.2.10, item 8, which indicates that loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements of the BWR SLC system that are exposed to sodium pentaborate solution. The GALL Report indicates that the existing AMP (GALL AMP XI.M2, "Water Chemistry") relies on monitoring and control of water chemistry to manage the aging effects of loss of material due to pitting and crevice corrosion. The GALL Report also indicates high concentrations of impurities at crevices and locations of stagnant flow conditions could cause loss of material due to pitting and crevice corrosion. The GALL Report recommends that the effectiveness of the Water Chemistry Control Program should be verified to ensure this aging is not occurring. The GALL Report further indicates that a one-time inspection of selected components at susceptible locations is an acceptable method to ensure that loss of material due to pitting and crevice corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The staff notes that in LRA Section 3.3.2.2.10, item 8, the applicant has identified appropriate AMPs and has identified the critical conditions requiring further review (i.e., the potential for water chemistry control to be ineffective in stagnant areas). The staff finds that LRA Section 3.3.2.2.10, item 8 is consistent with SRP-LR Section 3.3.2.2.10.

The staff also reviewed AMR items subordinate to LRA Table 3.3.1, item 3.3.1-30 which is associated with LRA Section 3.3.2.2.10, item 8. In its review, the staff noted that the applicant proposes that the components associated with item 3.3.1-30 are either fully consistent with the GALL Report or are consistent with the GALL Report in all respects except the component is different.

In its review of components subordinate to LRA item 3.3.1-30, for which the applicant assigned LRA Note A, the staff concurs with the applicant that these items are, in fact, consistent with the GALL Report. As described in SRP-LR Section 3.0.1, items which are consistent with the GALL Report are acceptable for license renewal.

In its review of components subordinate to LRA item 3.3.1-30, the staff noted that the components listed do not meet the precise definition of the GALL Report. However, the staff also noted that the corrosion mechanisms and rates expected in these components are similar to those expected for the components listed in the GALL Report and that the same AMP could be effectively employed. The staff accepts that the components under consideration are sufficiently similar to those actually included in SRP-LR Table 3.3.1, item 30 so as not to render them inconsistent with the GALL Report. As described in the SRP-LR, items which are consistent with the GALL Report are acceptable for license renewal.

Based on its review, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.10 criteria. For those line items that apply to LRA Section 3.3.2.2.10, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3)

3.3.2.2.11 Loss of Material Due to Pitting and Crevice Corrosion

LRA Section 3.3.2.2.11 addresses loss of material due to pitting, crevice, and galvanic corrosion for copper alloy piping and components exposed to treated water in the auxiliary and other systems. The applicant indicated that it will manage this aging through the use of its Water Chemistry Control – BWR Program (reviewed in SER Section 3.0.3). The effectiveness of the program will be confirmed by the One-Time Inspection Program (reviewed in SER Section 3.0.3) through an inspection of a representative sample of components crediting this program, including susceptible locations such as areas of stagnant flow.

The staff reviewed LRA Section 3.3.2.2.11 against the criteria in SRP-LR Section 3.3.2.2.11 which indicates that loss of material due to pitting, crevice, and galvanic corrosion could occur for copper alloy piping, piping components, and piping elements exposed to treated water. Therefore, the GALL Report recommends that the effectiveness of the Water Chemistry Control Program should be verified to ensure this aging is not occurring. The GALL Report indicates that a one-time inspection of selected components at susceptible locations is an acceptable method to ensure that loss of material due to pitting and crevice corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The staff notes that in LRA Section. 3.3.2.2.11, the applicant has identified appropriate AMPs and has identified the critical conditions requiring further review (i.e., the potential for water chemistry control to be ineffective in stagnant areas). The staff finds that LRA Section 3.3.2.2.11 is consistent with SRP-LR Section 3.3.2.2.11.

The staff also reviewed AMR items subordinate to LRA Table 3.3.1, item 3.3.1-31 which is associated with LRA Section 3.3.2.2.11. In its review, the staff noted that the applicant proposes that the components associated with item 3.3.1-31 are either fully consistent with the GALL Report or are consistent with the GALL Report in all respects except the component is different.

In its review of components subordinate to LRA item 3.3.1-31, for which the applicant assigned LRA Note A, the staff concurs with the applicant that these items are, in fact, consistent with the GALL Report. As described in SRP-LR Section 3.0.1, items which are consistent with the GALL Report are acceptable for license renewal.

In its review of components subordinate to LRA item 3.3.1-31, the staff noted that the components listed do not meet the precise definition of the GALL Report. However, the staff also noted that the corrosion mechanisms and rates expected in these components are similar to those expected for the components listed in the GALL Report and that the same AMP could be effectively employed. The staff accepts that the components under consideration are sufficiently similar to those actually included in SRP-LR Table 3.3.1, item 31 so as not to render them inconsistent with the GALL Report. As described in the SRP-LR, items which are consistent with the GALL Report are acceptable for license renewal.

Based on its review, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.11 criteria. For those line items that apply to LRA Section 3.3.2.2.11, 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 functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.2.12 Loss of Material Due to Pitting, Crevice, and Microbiologically Influenced Corrosion

LRA Section 3.3.2.2.12, item 1 addresses loss of material due to pitting, crevice, and MIC in stainless steel and copper alloy piping, piping components, and piping elements exposed to fuel oil. The applicant also indicated that there are no aluminum components exposed to fuel oil in the auxiliary systems. The applicant indicated that loss of material due to pitting, crevice, and MIC for stainless steel and copper alloy piping, piping components, and piping elements exposed to fuel oil is managed by the Diesel Fuel Monitoring Program. The Diesel Fuel Monitoring Program includes periodic monitoring and control of contaminants. The applicant indicated that the One-Time Inspection Program will provide a verification of the effectiveness of the Diesel Fuel Monitoring Program to manage loss of material due to pitting, crevice, and MIC through examination of stainless steel and copper alloy piping, piping components, and piping elements exposed to fuel oil. The applicant further indicated that the Fire Protection Program uses periodic inspections that will supplement the Diesel Fuel Monitoring Program for the diesel-driven fire pump fuel supply line.

The staff reviewed LRA Section 3.3.2.2.12, item 1 against the criteria in SRP-LR Section 3.3.2.2.12, which indicates that loss of material due to pitting, crevice, and MIC and fouling may occur in stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to fuel oil. The existing AMP relies on monitoring and control of fuel oil contamination to manage loss of material due to corrosion or fouling. SRP-LR Section 3.3.2.2.12 recommends that the effectiveness of the AMP should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material due to pitting, crevice, and MIC to verify the effectiveness of the AMP. SRP-LR Section 3.3.2.2.12 indicates that a one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the applicant's Diesel Fuel Monitoring Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3, found that the Diesel Fuel Monitoring Program provides aging management for loss of material through monitoring and control of fuel oil contamination, such as water or microbiological organisms. The staff also reviewed the applicant's One-Time Inspection Program. The staff's evaluation of this program, which is documented in SER Section 3.0.3, found that the One-Time Inspection Program is a one-time inspection that is consistent with the GALL Report's recommendations for GALL AMP XI.M32, "One-Time Inspection." The staff determined that the One-Time Inspection Program includes provisions for inspecting selected components so that there will be 90 percent confidence that 90 percent of the population does not experience degradation and is capable of detecting loss of material due to general, pitting, crevice, and MIC, if it should occur in the selected components. The staff noted that the One-Time Inspection Program includes provisions for increasing the inspection sample size and locations if degradation has been detected.

The staff reviewed the applicant's Fire Protection Program, which is documented in SER Section 3.0.3, and found that this program includes a diesel-driven fire pump inspection that requires that the pump and its driver be periodically tested and inspected to ensure that fuel supply lines can perform their intended functions. The staff noted that in addition to the recommendations of the GALL Report, the applicant is conservatively performing additional periodic inspection as part of the Fire Protection Program on the stainless steel and copper alloy tubing (diesel-driven fire pump fuel supply line). Based on the applicant's use of: (1) a one-time inspection to confirm the effectiveness of the Diesel Fuel Oil Monitoring Program consistent with the GALL Report; (2) a conservative periodic testing and inspection of the diesel-driven fire pump fuel supply lines only; and (3) the Diesel Fueling Monitoring Program to control contaminants in the fuel oil, the staff finds the applicant's proposed AMPs for managing the potential aging effect of loss of material due to pitting, crevice, and MIC for stainless steel and copper alloy piping, piping components, and piping elements, exposed to fuel oil in the fuel oil system and in the DGFO system to be acceptable.

Based on its review, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.12, item 1 criteria. For those line items that apply to LRA Section 3.3.2.2.12, item 1, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

LRA Section 3.3.2.2.12, item 2 addresses loss of material due to pitting, crevice, and MIC that may occur in piping, piping components, and piping elements. The applicant indicated that loss of material for stainless steel components exposed to lubricating oil is managed by the Oil Analysis Program. The Oil Analysis Program manages aging effects through periodic monitoring and control of contaminants, thus preserving an environment that is not conducive to corrosion. The applicant further indicated that the One-Time Inspection Program will provide a verification of the effectiveness of the Oil Analysis Program to manage loss of material due to pitting, crevice, and MIC through the examination of stainless steel components.

SRP-LR Section 3.3.2.2.12, item 2 indicates that loss of material due to pitting, crevice, and MIC may occur in stainless steel piping, piping components, and piping elements exposed to lubricating oil. The existing program periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always 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 programs. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the applicant's Oil Analysis Program and One-Time Inspection Program and its evaluations are documented in SER Section 3.0.3. The staff determined that the Oil Analysis Program includes periodic sampling and analysis of lubricating oil to determine if contaminants, particulates, and water are present. The staff noted that the presence of these impurities in the lubricating oil can create an environment that is conducive to age-related degradation such as loss of material, cracking, and fouling. The staff determined that the activities performed as part of this program will be capable of preserving an environment that will not promote loss of material, cracking, and fouling. The staff finds that these activities are consistent with the recommendations in the GALL Report and are adequate to manage loss of material due to pitting, crevice, and MIC in stainless steel piping, piping components, and piping elements exposed to lubricating oil. The staff verified that the applicant has credited its One-Time Inspection Program, which includes a one-time inspection of selected components at susceptible locations, to verify the effectiveness of the Oil Analysis Program to manage this aging effect. On the basis that the applicant's AMPs are consistent with those recommended in SRP-LR Section 3.3.2.2.12, item 2, the staff finds the applicant's use of the Oil Analysis Program and One-Time Inspection Program acceptable.

Based on its review, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.12 criteria. For those line items that apply to LRA Section 3.3.2.2.12, item 2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 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, which indicates that a loss of material due to wear may occur in the elastomer seals and components exposed to air-indoor uncontrolled (internal or external). The staff defines wear as 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 as there are no relative motions exerted on the elastomer. Where the aging effects of change in material properties and cracking are detected for elastomer components, they are managed by the PSPM Program. This item is not applicable to auxiliary systems. SRP-LR Section 3.3.2.2.13 indicates 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.

Based on its review, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.3.2.2.13. For those LRA line items to which this SRP-LR section applies, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.2.14 Cracking Due to Stress-Corrosion Cracking in the Standby Liquid Control System – For PWR only, not applicable for CNS

3.3.2.2.15 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA program.

3.3.2.3 AMR Results That Are Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.3.2-1 through 3.3.2-13 and 3.3.2.14-1 through 3.3.2.14-29, 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.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether or not 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. The staff's evaluation is documented in the following sections.

3.3.2.3.1 Loss of Material from the Internal Surfaces of the Phenolic Coated Carbon Steel Accumulator in the Standby Liquid Control System which is Exposed to Sodium Pentaborate Solution

LRA Table 3.3.2-1 addresses the loss of material from the internal surfaces of the phenolic coated carbon steel accumulator in the SLC system which is exposed to sodium pentaborate solution. The applicant proposes that this combination of material, environment, and component is not contained in the GALL Report. The applicant acknowledges that corrosion for this material and environment combination is possible and proposes to manage that corrosion through the use of its PSPM Program (reviewed in SER Section 3.0.3). The applicant further indicates that the phenolic coating is not credited as part of the management of aging. Based on this statement, the staff considered the efficacy of the proposed AMP relative to bare carbon steel material exposed to sodium pentaborate solution.

In its review of LRA Table 3.3.2-1, the staff noted that, for sodium pentaborate solutions exposed to stainless steel components, the GALL Report indicates that aging in the form of loss of material may occur and that this aging may be managed through a combination of the GALL AMP XI.M2, "Water Chemistry – BWR," and GALL AMP XI.M2, "One-Time Inspection." Given that the probability of corrosion for bare carbon steel in sodium pentaborate solutions is greater than for stainless steel, the staff believes that the AMP used should be more comprehensive than that proposed for stainless steel. The staff also noted that the Water Chemistry Program recommended by the GALL Report will be able to detect changes in the sodium pentaborate solution which may affect its corrosivity and will be able to detect soluble corrosion products in the solution.

By letter dated June 29, 2009, the staff issued RAI 3.3.2.3-1 requesting that the applicant propose an AMP containing periodic inspections and water chemistry analyses or to justify how the existing program, which does not appear to include water chemistry measurements, will adequately manage corrosion of the carbon steel accumulator.

In its response dated July 29, 2009, the applicant stated that the Water Chemistry Control Program (reviewed in SER Section 3.0.3) is used for the sodium pentaborate solution and is credited for other components in this system. While not specifically credited for this component, the use of the Water Chemistry Program assures the chemistry of the solution to which this component is exposed does not change. The applicant also indicated that direct inspections of the accumulators will be made under the PSPM Program. The staff finds the applicant's currently proposed AMP acceptable because the chemistry of the solution is managed as recommended by the GALL Report and the component is visually inspected under a periodic inspection program. The staff also considers the PSPM Program as rigorous as, if not more than, the One-Time Inspection Program called for by the GALL Report in detecting loss of material.

Based on this review, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.3.2 Copper Alloy Exposed to Air-Indoor (Internal)

The applicant indicated in LRA Tables 3.3.2-4 (DG system), 3.3.2-6 (fire protection-water systems), 3.3.2-7 (halon and CO_2 system), 3.3.2-8 (HVAC systems), and 3.3.2-13 (N_2 system) that piping, piping components, and piping elements fabricated from copper alloy 15 percent Zn or 8 percent Al and copper alloy material exposed to air-indoor (internal) do not have an aging effect, therefore, an AMP is not required. The AMR line items cite LRA Note G, which indicates that the environment is not addressed in the GALL Report for this component and material combination.

During its review, the staff noted that the LRA did not provide a justification as to why copper alloy greater than 15 percent Zn or 8 percent Al and copper alloy material exposed to air-indoor (internal) do not have an aging effect. Therefore, by letter dated June 29, 2009, the staff issued RAI 3.3-4 requesting that the applicant describe the environmental conditions that exist in the internal environment of these components and to justify why these components are not subject to an aging effect requiring management when exposed to air-indoor (internal). In its response dated July 29, 2009, the applicant stated that for copper alloy greater than 15percent Zn or 8 percent Al and copper alloy components described above the environmental conditions on the internal and external surface are identical. The applicant further indicated that the internal environment is consistent with the definition of air-indoor uncontrolled in Table IX.D of the GALL Report. The staff finds the applicant's response acceptable because (1) the applicant clearly defined the internal environment as being identical with the external environment, therefore resolving the staff's concern that the internal environment may contain contaminants and stagnant conditions.

The staff noted that the applicant defines the environment of air-indoor as "indoor air on systems with temperatures higher than the dew point" which is the same as the GALL Report definition for air-indoor uncontrolled, as defined in Table XI.D. The staff reviewed Section V.F of the GALL Report and noted that GALL AMR item V.F-3 indicates that piping, piping components, and piping elements fabricated of copper alloy that are exposed to air-indoor uncontrolled do not experience an aging effect requiring management. Therefore, the staff determined the applicant has appropriately identified that the copper alloy piping, piping components, and piping elements do not experience an aging effect requiring aging management because it is consistent with the recommendations of GALL AMR item V.F-3.

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 functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.3.3 Copper Alloy Exposed to Air-Outdoor (External)

The applicant indicated in LRA Table 3.3.2-12 (plant drains) and 3.3.2-13 (N_2 systems) that loss of material for piping, piping components, and piping elements fabricated from copper alloy greater than 15 percent Zn or 8 percent Al and copper alloy exposed to air-outdoor (external) will be managed using the External Surfaces Monitoring Program. The AMR line items cite LRA Note G, which indicates that the environment is not addressed in the GALL Report for this component and material combination.

The staff noted that the applicant defined air-outdoor as being exposed to air and weather conditions. The staff further noted that the applicant has appropriately and conservatively identified the potential aging effect of loss of material when exposed to the moist, possibly salt laden atmospheric air, ambient temperatures and humidity, and exposure to weather, including precipitation and wind. The staff reviewed the applicant's External Surfaces Monitoring Program and its evaluation is documented in SER Section 3.0.3. The staff determined that the External Surfaces Monitoring Program, which includes periodic visual inspections of external surfaces performed during system walkdowns, is adequate to manage loss of material for copper alloy greater than 15 percent Zn or 8 percent Al and copper alloy piping, piping components, and piping elements exposed to an air-outdoor environment. The staff noted that a visual inspection will be capable of identifying degradation on the external surface that will present itself in signs of corrosion, corrosion byproducts, coating degradation, discoloration on the surface, scale/deposits, and pits and surface discontinuities that are indicative of loss of material. On the basis of periodic visual inspections being performed during system walkdowns of these components by the External Surfaces Monitoring Program, the staff finds the applicant's use of the External Surfaces Monitoring Program acceptable.

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 functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.3.4 Copper Alloy Exposed to Steam (Internal)

The applicant indicated that copper alloy strainer housing and valve bodies in LRA Table 3.3.2-14-2 and that copper alloy coils and valve bodies in LRA Table 3.3.2-14-11 will be managed by the Water Chemistry Control – Auxiliary Systems Program for loss of material when exposed to steam (internal). The AMR line items cite LRA Note G, which indicates that the environment is not addressed in the GALL Report for this component and material combination.

By letter dated June 15, 2009, the applicant responded to RAI B.1.38-1 and its evaluation is documented in SER Section 3.0.3. In this letter, the applicant indicated that based on the design of the AS system electric boiler, it requires a high level of water conductivity. The applicant further indicated that this high level of water conductivity propagates the electric arc generated by the boiler coil. The staff noted that because of the design and requirements of these electric boilers, the system is not suitable to be controlled by the EPRI guidelines for chemistry control of CCW referenced by the GALL Report. The applicant indicated that the design of the chilled water portion of the HV system have requirements on the parameters monitored to reflect the design of the components, such that the EPRI guidelines are not suitable for these systems. The staff noted that the parameters monitored and acceptance criteria for these parameters are based on manufacturer's recommendations.

The staff reviewed the applicant's Water Chemistry Control – Auxiliary Systems Program and its evaluation is documented in SER Section 3.0.3. The staff noted that this program consists of sampling and analysis of water from these systems in order to minimize the exposure of an aggressive environment that may lead to loss of material and cracking. The staff further noted that this program includes certain acceptance criteria in accordance with industry guidelines such as pH, conductivity, phosphate, sulfite, and iron in the AS system and the HV system. Furthermore, the staff noted that the applicant is conservatively performing a one-time inspection of a sample of components most susceptible to this aging effect to verify the effectiveness of the Water Chemistry Control – Auxiliary Systems Program. The staff noted these AMR line items did not explicitly credit the One-Time Inspection Program; however, because a one-time inspection is integrated into the Water Chemistry Control – Auxiliary Systems Program, the staff finds this to be acceptable. The staff determined that maintaining water chemistry in these systems will be capable of mitigating loss of material and cracking and that the one-time inspection is conservative and will provide verification of the program's effectiveness.

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 functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.3.5 Stainless Steel Exposed to Air-Indoor (Internal)

In LRA Tables 3.3.2-04, 3.3.2-07, 3.3.2-08, 3.3.2-12, 3.3.2-13, 3.3.2-14-16, and 3.3.2-14-20, the applicant indicated that piping, piping components, and piping elements fabricated from stainless steel material exposed to air-indoor (internal) do not have an aging effect, therefore an AMP is not required. The AMR line items cite LRA Note G, which indicates that the environment is not addressed in the GALL Report for this component and material combination.

During its review, the staff noted that the LRA did not provide a justification as to why stainless material exposed to air-indoor (internal) does not have an aging effect. Therefore, by letter dated June 29, 2009, the staff issued RAI 3.3-4 requesting that the applicant describe the environmental conditions that exist in the internal environment of these components and to justify why these components are not subject to an aging effect requiring management when exposed to air-indoor (internal). In its response dated July 29, 2009, the applicant stated that for all stainless steel components described above, the environmental conditions on the internal and external surface are identical. The applicant further indicated that the internal environment is consistent with the definition of air-indoor uncontrolled in Table IX.D of the GALL Report. The staff finds the applicant's response acceptable because the applicant clearly defined the internal environment as being identical with the external environment, therefore resolving the staff's concern that the internal environment may contain contaminants and stagnant conditions.

The staff noted that the applicant defines the environment of air-indoor as "indoor air on systems with temperatures higher than the dew point" which is the same as the GALL Report definition for air-indoor uncontrolled, as defined in Table XI.D of the GALL Report. The staff reviewed Section VII.J of the GALL Report and noted that GALL AMR item VII.J-16 indicates that piping, piping components, and piping elements fabricated of stainless steel that are exposed to air-indoor uncontrolled do not experience an aging effect requiring management. Therefore, the staff determined the applicant has appropriately identified that the stainless steel piping, piping components, and piping elements do not experience an aging effect requiring aging management because it is consistent with the recommendations of GALL AMR item VII.J-16.

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 functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.3.6 Stainless Steel Exposed to Air-Outdoor (External)

In LRA Tables 3.3.2-04, 3.3.2-08, 3.3.2-12, and 3.3.2-13, the applicant proposed to manage loss of material for piping, piping components, and piping elements fabricated from stainless steel exposed to air-outdoor (external) using the External Surfaces Monitoring Program. The AMR line items cite LRA Note G, which indicates that the environment is not addressed in the GALL Report for this component and material combination.

The staff noted that the applicant defined air-outdoor as being exposed to air and weather conditions. The staff further noted that the applicant has appropriately and conservatively identified the potential aging effect of loss of material when exposed to the moist, possibly salt laden atmospheric air, ambient temperatures and humidity, and exposure to weather, including precipitation and wind. The staff reviewed the applicant's External Surfaces Monitoring Program and its evaluation is documented in SER Section 3.0.3. The staff determined that the External Surfaces Monitoring Program, which includes periodic visual inspections of external surfaces performed during system walkdowns, is adequate to manage loss of material for stainless steel piping, piping components, and piping elements exposed to an air-outdoor environment. The staff noted that a visual inspection will be capable of identifying degradation on the external surface that will present itself in signs of corrosion, corrosion byproducts, coating degradation, discoloration on the surface, scale/deposits, and pits and surface discontinuities that are indicative of loss of material. On the basis of periodic visual inspections being performed during system walkdowns of these components by the External Surfaces Monitoring Program, the staff finds the applicant's use of the External Surfaces Monitoring Program acceptable.

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 functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.3.7 Stainless Steel and Copper Alloy Exposed to Liquid Nitrogen (External and Internal)

In LRA Table 3.3.2-13, the applicant indicated that piping, piping components, piping elements, and heat exchanger components fabricated from copper alloy, copper alloy greater than 15 percent Zn or greater than 8 percent Al and stainless steel material exposed to liquid nitrogen (external or internal) do not have an aging effect, therefore an AMP is not required. The AMR line items cite LRA Note G, which indicates that the environment is not addressed in the GALL Report for this component and material combination.

The staff noted that copper alloy, copper alloy greater than 15 percent Zn or greater than 8 percent Al and stainless steel are often used in applications of cryogenic temperatures (including exposure to liquid nitrogen) because they retain high degrees of ductility and toughness (Metals Handbook Desk Edition, American Society for Metals, 1985). The staff also noted that materials with faced centered cubic crystal structures, such as copper alloys and stainless steel, retain their toughness and, therefore, do not become embrittled at cryogenic temperatures (Cryogenic Engineering, Second Edition, Revised and Expanded by Thomas Flynn, 2004). The staff noted that there has been no industry OE of age-related degradation of components due to exposure with liquid nitrogen.

The staff notes that the boiling point of liquid nitrogen is −195.8 ^{o}C. The staff reviewed section UHA-51(d)(1)(a) of the ASME Boiler and Pressure Vessel Code Section VIII, Division 1, 2007 Edition and noted that it states stainless steel with minimum design metal temperatures (MDMT) of −196 ^{o}C and warmer are exempt from impact testing. The staff also noted that in section UNF-65 of ASME Section VIII, Division 1, 2007 states that impact testing is not required for copper and copper alloys if the material is used at temperatures of −198 ^{o}C or warmer. The staff noted that stainless steel, copper, and copper alloy are exempt from impact testing when exposed to liquid nitrogen because the boiling point of liquid nitrogen is not colder than those temperatures specified in ASME Code Section VIII, Division 1 for these materials. Based on its review, the staff determined that aging effects associated with subzero temperatures, such as cracking and embrittlement, are not aging effects requiring management for copper alloy, copper alloy greater than 15 percent Zn or greater than 8 percent Al and stainless steel exposed to liquid nitrogen because these materials do not undergo a marked drop in impact resistance at subzero temperatures. The staff noted that liquid nitrogen is inert and contains negligible amounts of free oxygen and, therefore, determines that corrosion of these materials is not an aging effect requiring management.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.3.8 Plastic, Air-Indoor/Treated (External/Internal)

In LRA Tables 3.3.2-6, 3.3.2-12, 3.3.2-14-18, and 3.3.2-14-29, the applicant identified that there is no aging effect requiring management or AMP for plastic tubing, valve bodies, hoses, and pump casings in either a treated air (internal and external) or indoor air (internal and external) environment. The AMR line items cite LRA Note F which indicates that the material is not addressed in the GALL Report for this component and environment.

In RAI 3.3.2-4, dated June 29, 2009, the staff requested further details as to the specific type of plastic materials to be used in the application. Plastic materials have different materials properties that vary depending on chemical compositions which may or may not have an aging effect in indoor air (internal and external) environment.

In its response to the RAI dated June 29, 2009, the applicant stated that the polyvinyl chloride (PVC) being used is a thermoplastic material composed of polymers of vinyl chloride. The polyvinyl chloride is manufactured from sodium chloride (NaCl) and natural gas, PVC is relatively unaffected by water, concentrated alkalis, and non-oxidizing acids, and oils. However, chemical attack is a potential aging mechanism for PVC and other thermoplastics located in outdoor and indoor environments due to exposure to ultra violet radiation (e.g., sunlight, fluorescent lighting), ozone, or ionizing radiation. The applicant also reviewed each table where plastics were used and evaluated its usage.

Based on its review, the staff finds the response to RAI 3.3.2-4 acceptable because the plastic was identified as PVC. The staff also finds the applicants usage of PVC acceptable in the environments that the materials are used in because PVC is relatively unaffected by water and will not be exposed to ultra violet radiation such as sunlight for extending periods of time as it will be used in an indoor air (internal and external) environment.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21(a)(3).

3.3.2.3.9 Teflon, Air-Indoor (Internal)

In LRA Table 3.3.2-7, the applicant identified that there is no aging effect requiring management or aging managing program for a Teflon flex hose in indoor air (internal) environment. The AMR line items cite LRA Note F which indicates that the material is not addressed in the GALL Report for this component and environment.

The staff reviewed the LRA for the usage of Teflon flex hose. The finds that the Teflon flex hose is affixed at both ends of the hose and will undergo the hose will bare no cyclic loading. The teflon flex hose will be in and indoor air (internal) environment in which Teflon is very resilient to this ambient environment. In its LRA, the applicant defines Indoor air as being inerted with nitrogen, the primary containment air is conservatively considered equivalent to reactor building ambient air.

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 functions will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21(a)(3).

3.3.2.3.10 Plastics, Treated Water (Internal)

In LRA Tables 3.3.2-14-18 and 3.3.2-14-29, an aging effect requiring management or AMP for plastic pump casing in a treated water (internal) environment was not identified. The AMR line items cite LRA Note F, which indicates that the material is not addressed in the GALL Report for this component and environment.

Based on its review, the staff finds the response to RAI 3.3.2-4, previously discussed in section 3.3.2.3.8, dated July 29, 2009, acceptable because the plastic was identified as PVC. The staff finds the applicants usage of PVC acceptable in the environments that the materials shall be used in because of PVC is relatively unaffected by treated water. The staff also finds that this pump casing will not be subject to a cyclic loading aging effect requiring management.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21(a)(3).

3.3.2.3.11 Fiberglass Air-Indoor (External/Internal)

In LRA Tables 3.3.2-4, the applicant did not identify an aging effect requiring management or Aging managing program for a fiberglass silencer in an indoor air (external/internal) environment. The AMR line items cite LRA Note F which indicates that the material is not addressed in the GALL Report for this component.

The staff reviewed the applicant’s usage of fiberglass under an air-indoor (external/internal) environment. The applicant states that an air-indoor environment is on systems with temperatures higher than the dew point. Although inerted with nitrogen, primary containment air is conservatively considered as air-indoor. The staff questioned this determination because humidity is easily absorbed in fiberglass. Fiberglass absorbs moisture and can expand microcracks within the matrix of the material and decrease its tenacity. In RAI 3.3.2-6, dated June 29, 2009, the staff requested that the applicant to provide justification as to why fiberglass under an air-indoor environment is acceptable for this component.

In its response to the RAI dated June 29, 2009, the applicant stated that Fiberglass is a glass based material that, similar to glass, is highly resistant to corrosion in most environments especially an indoor air environment. The applicant further states that there have been no instance of fiberglass failure due to an aging effect in an air-indoor environment found in industry OE searches; therefore, no aging effects are identified for the fiberglass component (intake air silencer).

Based on its review, the staff finds the response to RAI 3.3.2-6 acceptable because glass-based fiberglass is very resistant to water and moisture rich environments. Further, the staff concludes that the fiberglass will be in an indoor-air (internal or external) environment which will not be moisture rich and no aging management program is required for the fiberglass silencer**.**

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 functions will be maintained consistent with the CLB for the period of extended operation in accordance with 10 CFR 54.21(a)(3).

3.3.2.3.12 Aluminum Air-Outdoor (External/Internal)

In LRA Tables 3.3.2-5 and 3.3.2-8, the applicant proposed to manage loss of material for aluminum flame arrestor, fan housing, and louver housing in an outdoor air (external/internal) environment using the External Surfaces Monitoring Program. The AMR line items cite LRA Note G, which indicates that the environment is not addressed in the GALL Report for this component and material.

The staff reviewed the applicant's External Surfaces Monitoring Program and its evaluation is documented in SER Section 3.0.3. The applicant indicated that its External Surfaces Monitoring Program is credited with managing loss of material from internal surfaces for situations in which the internal and external material and environment combinations are the same such that the external surface condition is representative of the internal surface condition. The applicant further indicated that surfaces that are inaccessible during plant operations are inspected during refueling and inspected at frequencies to assure the loss of material is adequately managed.

Based on its review, the staff finds that the components will be monitored for loss of material at an adequate frequency to assure that the components will perform their intended function. The staff finds that the internal and external material and environment conditions are the same. Therefore, external surface monitoring of the external surface is representative to internal surface monitoring of aluminum components.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.3.13 Aluminum Air Treated (Internal)

In LRA Tables 3.3.2-10, 3.3.3-10, and 3.3.2-14-12, the applicant identified that there is no aging effect requiring management or AMP for aluminum filter housings, lubricators, and valve bodies in a treated air (internal) environment. The AMR line items cite LRA Note G, which indicates that the environment is not addressed in the GALL Report for this component and material.

In its LRA, the applicant has defined treated air as air that is dried and filtered. Based on the staff's review of the applicant's definition of treated air, the staff has determined that dry and filtered air will not cause degradation to the aluminum components. The staff finds that treated air will not cause any corrosion to the aluminum surfaces of the components which may lead to material degradation. Moisture is generally required in order to start the process of aluminum oxidation and dry, filtered air does not contain moisture. Therefore, the staff finds that no aging effect or AMP is required for this component in order for it to maintain its intended function.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not 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, in accordance with 10 CFR 54.21(a)(3).

3.3.2.3.14 Cracking in the Components in the Lubricating Oil Environment (Internal)

In LRA Table 3.3.2-4, the applicant addressed the AMR items of stainless steel restriction orifice, thermowell, tubing, and valve body in the auxiliary systems that are subject to cracking in a lubricating oil environment. The applicant also indicated that the consistency note for the AMR items is LRA Note H, which means that aging effect is not addressed in the GALL Report for the component, material, and environment combination. The applicant indicated that the Oil Analysis Program is credited for managing the cracking in the stainless steel components exposed to the lubricating oil environment.

As the applicant indicated, the staff found that the GALL Report does not address cracking in stainless steel components in a lubricating oil environment. To further evaluate the AMR results, the staff issued RAI 3.2.2.3-1, by letter dated June 29, 2009, requesting the applicant to provide the aging mechanism of the cracking so that the effectiveness of the Oil Analysis Program for managing the cracking can be evaluated. The staff also requested justification why the Oil Analysis Program can adequately manage the aging effect. The applicant responded to the RAI by letter dated on July 29, 2009. In the response, the applicant stated that the aging mechanisms that cause cracking in the lubricating oil environment are SCC and intergranular attack. The applicant also stated that for these aging mechanisms in an oil environment, a corrosive environment (water) and a susceptible material must be present. The applicant further stated that the components above are made of a susceptible material (stainless steel).

In addition, the applicant stated that the lubricating oil environment is normally not corrosive unless there is water in the oil in sufficient quantities. The applicant also stated that the Oil Analysis Program described in LRA Section B.1.28 manages the oil environments through periodic sampling and analysis such that water content is maintained at a level that precludes a corrosive environment and thereby manages cracking of stainless steel. The applicant further stated that the One-Time Inspection Program uses inspections or NDEs of representative samples to verify that the program is effective at managing aging effects.

As described above, the applicant clarified that the aging mechanisms for the cracking are SCC and intergranular attack and the Oil Analysis Program ensures to preclude a corrosive environment by managing the oil environments through periodic sampling and analysis. The staff's review of the Oil Analysis Program is documented in SER Section 3.0.3. The staff finds that the Oil Analysis Program is adequate to maintain oil systems free of contaminants such that the oil environment is not conducive to loss of material, cracking, or fouling. In addition, the staff finds that the One-Time Inspection Program that uses inspections or NDEs of representative samples is adequate to verify the effectiveness of the Oil Analysis Program. Therefore, the staff finds that the applicant's aging management with the Oil Analysis Program and One-Time Inspection Program is adequate to manage the cracking due to SCC and intergranular attack for the AMR items as addressed in the applicant's response to the RAI.

On the basis of its review, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.3.15 Loss of Material in the Rupture Disc in the Air-Outdoor Environment (External)

In LRA Table 3.3.2-13, page 3.3-149, the applicant indicated that the nickel alloy rupture disc in the N_2 system of the auxiliary systems is exposed to an outdoor air environment on the external surface of the rupture disc and the aging effect of the AMR item is loss of material. The applicant described that the consistency note for this item is LRA Note G, which means the environment is not included in the GALL Report for the component and material. The applicant credited the External Surfaces Monitoring Program to manage the aging effect.

The staff reviewed the AMR item of the nickel alloy rupture disc in comparison with the GALL Report and confirmed the applicant's Note G, as the GALL Report does not include an AMR item for the aging effect of an outdoor air environment on nickel alloy external surfaces.

The staff noted that in the GALL Report loss of material is an aging effect on the external surface of steel piping, piping elements, and piping components of the auxiliary systems, which are exposed to an air-outdoor environment as is the case with GALL Report item VII.H1-8. The staff also noted that the recommended AMP for the steel components is GALL AMP XI.M36, "External Surfaces Monitoring Program." In its review of the relevant technical information, the staff found that the AMR results of the applicant were adequate and acceptable with the relevant AMP on the basis that the GALL Report recommends the External Surfaces Monitoring Program (GALL AMP XI.M36) to manage loss of material of steel components in the air-outdoor environment, although the GALL report does not include an AMR item corresponding to nickel alloy components in the given combination of environment and aging effect.

The staff's review of the applicant's External Surfaces Monitoring Program is documented in SER Section 3.0.3. In its review, the staff finds that the External Surfaces Monitoring Program includes visual inspections for external surfaces for evidence of loss of material and corrective actions to manage the aging effects of loss of material such that the AMP is adequate to manage the loss of material of the nickel alloy rupture disc in the auxiliary systems.

On the basis of its review, the staff determines that the applicant's proposed program is acceptable for managing the aging effect in the applicable component. The staff concludes that the applicant has demonstrated that the effects of aging for the component will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.3.16 No Aging Effect in the Rupture Disc in the Gas Environment (Internal)

In LRA Table 3.3.2-13, page 3.3-149, the applicant indicated that the nickel alloy rupture disc in the N_2 system of the auxiliary systems is exposed to a N_2 gas environment on the internal surface of the rupture disc and the AMR item is not subject to an aging effect. The applicant described that the LRA Note for this item is G, which means the environment is not included in the GALL Report for the component and material.

The staff reviewed the AMR item of the nickel alloy rupture disc in comparison with the GALL Report and verified Note G since the GALL Report does not include gas environments for nickel alloy internal surfaces. The staff determined that the applicant's statement is acceptable in consideration of the benign nature of the N_2 gas environment that is regarded not to induce aging effect on nickel alloy to such a level as aging management is required.

On the basis of its review in comparison with the GALL Report, the staff determines that the AMR item has no aging effect and the AMR results in the LRA are adequate and acceptable for the nickel alloy rupture disc item exposed to the gas environment.

3.3.2.3.17 Auxiliary System-Service Water System

In LRA Table 3.3.2-3, the applicant proposed to manage loss of material for carbon steel bolts and fasteners externally exposed to a raw water environment using the Bolting Integrity Program. The AMR line item cites LRA Note E, which indicates that the AMP credited is different from the program recommended by the GALL Report, XI.M20, "Open-Cycle Cooling Water System."

In LRA Tables 3.3.2-3, 3.3.2-4, 3.3.2-5, 3.3.2-6, 3.3.2-8, 3.3.2-12, 3.3.2-13, 3.3.2-14-11, 3.3.2-14-18, 3.3.2-14-23, and 3.3.2-14-26, the applicant proposed to manage loss of preload-thermal, gasket creep, loosening for carbon and stainless steel bolting and fasteners externally exposed to outdoor air, condensation, raw water, and soil environments using the Bolting Integrity Program. The AMR line items cite Plant-Specific Note 309, which indicates that the environments stated in the LRA for these items are considered by the applicant to be equivalent to the NUREG-1801 defined environments of air with reactor coolant leakage or air indoor uncontrolled for the evaluation of the loss of preload aging effect since loss of preload is not significantly dependent on environment.

The LRA credits the Bolting Integrity Program to manage this aging effect and the staff's evaluation of this AMP is documented in SER Section 3.0.3. The staff verified that the Bolting Integrity Program is an existing CNS program that will manage (a) the loss of material aging effect for carbon steel bolts and fasteners in the environment listed and (b) the loss of preload through periodic inspection and preventive measure, in accordance with the recommendations specified by the GALL Report. The staff also reviewed the Bolting Integrity Program to verify that loss of preload due to thermal effects, gasket creep, and self loosening will be managed in accordance with the recommendations specified by the Bolting Integrity Program. The staff finds that because these components will be inspected through the specifications of the Bolting Integrity Program, they will be adequately managed.

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 functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.3.18 Steel Bolts and Fasteners Externally Exposed to Outdoor Air, Condensation, Raw Water, or Soil Environments

In LRA Tables 3.3.2-3, 3.3.2-4, 3.3.2-5, 3.3.2-6, 3.3.2-8, 3.3.2-12, 3.3.2-13, 3.3.2-14-11, 3.3.2-14-18, 3.3.2-14-23, and 3.3.2-14-26, the applicant proposed to manage loss of preload due to thermal effects, gasket creep, and self-loosening for carbon and stainless steel bolting and fasteners externally exposed to outdoor air, condensation, raw water, and soil environments using the Bolting Integrity Program. The AMR line items cite generic note A, which indicates that the AMR line items are consistent with the NUREG-1801 items. The AMR line items also cite

Plant Specific Note 309, which indicates that the environments stated in the LRA for these items are considered by the applicant to be equivalent to the NUREG-1801 defined environments of air with reactor coolant leakage or air indoor uncontrolled for the evaluation of the loss of preload aging effect since loss of preload is not significantly dependent on environment.

The LRA credits the Bolting Integrity Program to manage this aging effect and the staff's evaluation of this AMP is documented in SER Section 3.0.3. The staff noted that the mechanisms identified in the GALL Report as causing loss of preload in carbon steel bolts are thermal effects, gasket creep, and self-loosening, which are not all dependent on the bolting material or environment. The staff also noted that activities in the Bolting Integrity program that control and manage loss of preload are effective for various bolting materials. Additionally, the staff verified that the Bolting Integrity Program is an existing CNS program that will manage (a) the loss of material aging effect for carbon steel bolts and fasteners in the environment listed and (b) the loss of preload through periodic inspection and preventive measure, in accordance with the recommendations specified by the GALL Report. The staff also reviewed the CNS AMP B.1.2 "Bolting Integrity Program" to verify that loss of preload due to thermal effects, gasket creep, and self loosening will be managed in accordance with the recommendations specified by the GALL Report AMP XI.M18 "Bolting Integrity" Program. On the basis of its review, the staff finds that because these components will be inspected through the specifications of the CNS AMP B.1.2 "Bolting Integrity Program," they will be adequately managed.

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, in accordance with 10 CFR 54.21(a)(3).

3.3.2.3.19 Carbon Steel Bolts and Fasteners Externally Exposed to Raw Water

In LRA Table 3.3.2-12, the applicant proposed to manage loss of material for carbon steel bolts and fasteners externally exposed to a raw water environment using the Periodic Surveillance and Preventive Maintenance Program. The AMR line item cites LRA Generic Note E, which indicates that the AMP credited is different from that which is recommended by the GALL Report.

The LRA credits the Periodic Surveillance and Preventive Maintenance Program to manage this aging effect as opposed to the GALL Report AMP XI.M20 "Open-Cycle Cooling Water System." The staff's evaluation of this AMP is documented in SER Section 3.0.3. The Periodic Surveillance and Preventive Maintenance Program is an existing CNS program that will manage the loss of material for carbon steel bolts and fasteners and is documented in LRA Section B.1.31, "Periodic Surveillance and Preventive Maintenance Program." The applicant explained that the bolting line items in question are located in submerged environments. Bolts in these environments are coated or wrapped, and the inspection of these coatings and wrappings are conducted in accordance with the Buried Piping and Tanks and Periodic Surveillance and Preventive Maintenance programs. In cases where inspection reveals that bolts were exposed due to degradation or removal of the coating or wrappings for maintenance, the elements of the Bolting Integrity program would be implemented to assure that the intended function of the bolting is maintained. The staff reviewed the PSPM Program to verify that loss of material for carbon steel bolts and fasteners exposed to raw water will be managed in accordance with the recommendations specified by the Bolting Integrity Program. On the basis of its review, the staff finds that because these components will be inspected through the specifications of the Bolting

Integrity Program, which are implemented by the PSPM Program, they will be adequately managed.

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, in accordance with 10 CFR 54.21(a)(3).

3.3.2.3.20 Stainless Steel Bolts and Fasteners Externally Exposed to An Outdoor Environment

In LRA Tables 3.3.2-4, 3.3.2-6, 3.3.2-8, 3.3.2-12, and 3.3.2-13, the applicant proposed to manage loss of material for stainless steel bolts and fasteners externally exposed to an outdoor environment using the Bolting Integrity Program. The AMR line item cites LRA Note G, which indicates that the environment is not addressed in the GALL Report for this component and material.

The LRA credits the Bolting Integrity Program to manage this aging effect and the staff's evaluation of this AMP is documented in SER Section 3.0.3. The staff verified that the Bolting Integrity Program is an existing CNS program that will manage the loss of material aging effect for stainless steel bolts and fasteners in the environment listed, in accordance with the recommendations specified by the GALL Report. On the basis of its review, the staff finds that because these components will be inspected through the specifications of the Bolting Integrity Program, they will be adequately managed.

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 functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.3.2.3.21 Stainless Steel Bolts and Fasteners Exposed to Air-Outdoor (External)

In LRA Tables 3.3.2-4, 3.3.2-6, 3.3.2-8, 3.3.2-12, and 3.3.2-13, the applicant proposed to manage loss of material for stainless steel bolts and fasteners externally exposed to an outdoor air environment using the Bolting Integrity Program. The AMR line item cites Plant Specific Note G, which indicates that the environment is not addressed in the GALL Report for this component and material.

The LRA credits the Bolting Integrity Program to manage this aging effect and the staff's evaluation of this AMP is documented in SER Section 3.0.3. Stainless Steel is susceptible to a variety of aging effects and mechanisms, including loss of material. The staff verified that the Bolting Integrity Program is an existing CNS program that will manage the loss of material aging effect for stainless steel bolts and fasteners in the outdoor air environment listed, in accordance with the recommendations specified by the GALL Report. The staff finds that because these components will be inspected through the specifications of the Bolting Integrity Program, they will be adequately managed.

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, in accordance with 10 CFR 54.21(a)(3).

3.3.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the auxiliary systems components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.4 Aging Management of Steam and Power Conversion Systems

This section of the SER documents the staff's review of the applicant's AMR results for the S&PC systems components and component groups of:

- MSIV leakage pathway
- miscellaneous S&PC systems in-scope in accordance with 10 CFR 54.4(a)(2)

3.4.1 Summary of Technical Information in the Application

LRA Section 3.4 provides AMR results for the S&PC systems components and component groups. LRA Table 3.4.1, "Summary of Aging Management Programs for Steam and Power Conversion Systems Evaluated in Chapter VIII of NUREG-1801," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the S&PC systems components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry OE 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 OE included a review of the GALL Report and OE 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 S&PC systems components within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. Details of the staff's evaluation are documented in SER Section 3.4.2.1.

The staff also reviewed AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the SRP-LR Section 3.4.2.2 acceptance criteria. The staff's evaluations are documented in SER Section 3.4.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with, or not addressed in, the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed were appropriate for the material-environment combinations specified. The staff's evaluations are documented in SER Section 3.4.2.3.

For SSCs which the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR line items and the plant's OE to verify the applicant's claims.

In summary, the staff's review of the S&PC systems component groups followed any one of several approaches. One approach, documented in SER Section 3.4.2.1, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.4.2.2, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.4.2.3, reviewed AMR results for components that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the S&PC systems components is documented in SER Section 3.0.3.

3.4.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.4.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the S&PC systems components:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- Flow-Accelerated Corrosion Program
- Oil Analysis Program
- One-Time Inspection Program
- Periodic Surveillance and Preventive Maintenance (PSPM) Program
- Selective Leaching Program
- Water Chemistry Control – BWR Program

In LRA Tables 3.4.2-1 and 3.4.2-2-1 to 3.4.2-2-13, the applicant provided a summary of AMRs for the S&PC system components and identified which AMR is considered 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 review determined whether the plant-specific components of these GALL Report component groups were bounded by the GALL Report evaluation.

The staff reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the ESF components that are subject to an AMR. On the basis of its review, the staff determines that, for AMRs not requiring further evaluation, as identified in LRA Table 3.2.1, the applicant's references to the GALL Report are acceptable and no further staff review is required, with the exception of the following AMRs that the applicant identified were consistent with the AMRs of the GALL Report and for which the staff felt were in need of additional clarification and assessment. The staff's evaluations of these AMRs are provided in the following sections.

3.4.2.1.1 Loss of Material Due to General Corrosion from the External Surfaces of Steel Components Exposed to Uncontrolled Indoor Air, Outdoor Air, or Condensation

SRP-LR and LRA Table 3.4.1, item 3.4.1-28 address the loss of material due to general corrosion from the external surfaces of steel components exposed to uncontrolled indoor air, outdoor air, or condensation. Both the SRP-LR and LRA item 3.4.1-28 propose the use of the AMP "External Surfaces Monitoring," (LRA B.1.14 and GALL Report AMP XI.M36) to manage the aging process. However, for at least some LRA Table 2 items subordinate to LRA item 3.4.1-28, the applicant proposes that no aging effect is present and that no AMP is required.

In its review of LRA item 3.4.1-28, the staff noted that the applicant's basis for stating that no aging effect was present was that the temperature of the components under consideration was above the dewpoint. The GALL Report finds that the aging effect of loss of material due to exposure of steel surfaces to indoor air, which can result in condensation but only rarely, should be considered.

By letter dated July 14, 2009, the staff issued RAI 3.4.2.1-1 requesting that the applicant justify why aging management is not required for these components given that, during normal plant events such as refueling, the components under consideration will be at or near ambient temperature, and therefore, exposed to condensation.

The applicant responded by letter dated August 13, 2009. In its response, the applicant stated that the temperature of the components under consideration was normally sufficiently high that condensation could not occur. The applicant acknowledged that there were brief periods of time during outages whereby surface temperatures were sufficiently low that condensation was possible. The applicant indicated that, based on OE, these time periods were too short to result in significant loss of material. The staff finds the applicant's proposal that aging need not be managed for these components acceptable because condensation is required for loss of material and the time period where condensation is possible is too short to result in significant component degradation.

The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.4.2.1.2 Loss of material Due to General, Crevice and Pitting Corrosion from the Internal Surfaces of Steel Piping, Piping Components, and Piping Elements Exposed to Outdoor Air or Condensation

LRA and SRP-LR Table 3.4.1, item 3.4.1-30 address the loss of material due to general, crevice and pitting corrosion from the internal surfaces of steel piping, piping components, and piping elements exposed to outdoor air or condensation. The applicant proposes to manage this aging process through the use of its AMP "External Surfaces Monitoring" (LRA B.1.14). The GALL

Report recommends that this aging process be managed through the use of the AMP "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" (GALL Report, Volume 2, Chapter XI.M38). The proposed AMP is not consistent with the AMP proposed by the GALL Report. As a result, the applicant proposes that the AMR items associated with item 3.4.1-30 are consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited.

In its review of LRA item 3.4.1-30 the staff noted that the component being considered is the internal surface of steel piping. The staff also noted that the AMP proposed by the applicant is primarily designed to monitor the condition of external surfaces. The staff further noted that the prediction of internal corrosion based on monitoring external surfaces of the same component is possible only when the interior and exterior environments of that component are identical. Lastly, the staff noted that sufficient information was not provided in the application to permit a determination that the interior and exterior environments of the components under consideration are identical.

By letter dated July 14, 2009, the staff issued RAI 3.4.2.1-2 requesting that the applicant select an AMP designed to monitor the internal surfaces of steel piping exposed to outdoor air or condensation, or justify why an external inspection is appropriate to manage internal corrosion. Justification should be sufficient to demonstrate that the environments are identical in terms of items such as coatings, temperature, velocity, humidity, and contaminants.

The applicant responded by letter dated July 29, 2009. In that response the applicant indicated that it had revised AMR line items under consideration to correct materials of construction and to select its PSPM Program as the proposed AMP. The staff finds the applicant's currently proposed AMP acceptable because it contains test methods (visual inspection) appropriate for detecting loss of material from the internal surfaces of the components under consideration.

The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.4.2.1.3 Loss of Material Due to Pitting, Crevice, and Microbiologically Influenced Corrosion as Well as Fouling for Stainless Steel and Copper Alloy Piping, Piping Components, and Piping Elements Exposed to Raw Water

LRA and SRP-LR Table 3.4.1, item 3.4.1-32 address the loss of material due to pitting, crevice, and MIC as well as fouling for stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water. The applicant proposes to manage this aging process through the use of its PSPM Program (reviewed in SER Section 3.0.3). The GALL Report recommends that this aging process be managed through the use of the AMP "Open Cycle Cooling Water System" (GALL AMP 2 XI.M20). The proposed AMP is not consistent with the AMP proposed by the GALL Report. As a result, the applicant proposes that the AMR items associated with item 3.4.1-32 are consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited.

In its review of LRA item 3.4.1-32, the staff noted that the item under consideration is tubing serving the CW system. The staff also noted that the aging effect under consideration is loss of material. The staff further noted that at many plants, portions of the CW system are considered to be safety related due to their relationship with the service water system. Based on the information presented in the application, the staff must assume that the applicant correctly chose to apply item 3.4.1-32 to this component. In the absence of additional information, the staff must also assume that GL 89-13 applies to the component under consideration.

By letter dated July 14, 2009, the staff issued RAI 3.4.2.1-4 requesting that the applicant propose an AMP equivalent to the open cycle cooling water AMP or justify why GL 89-13 does not apply to this system.

The applicant responded by letter dated Aug 13, 2009. In this response the applicant indicated that the information provided in its response to RAI 3.4.2.1-3 also applies to this RAI 3.4.2.1-4. In response to RAI 3.4.2.1-3, the applicant justified why GL 89-13 did not apply to the component in question,(i.e., it does not transfer heat from safety related systems to the ultimate heat sink). The staff finds the applicant's currently proposed AMP acceptable because it contains inspection techniques capable of detecting the aging effect under consideration; and, additional testing as required by GL 89-13 is not required.

The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.4.2.1.4 Loss of Material Due to Pitting, Crevice, and Microbiologically Influenced Corrosion of Stainless Steel Piping, Piping Components, and Piping Elements Exposed to Raw Water

LRA and SRP-LR Table 3.4.1, item 3.4.1-32 address the loss of material due to pitting, crevice, and MIC of stainless steel piping, piping components, and piping elements exposed to raw water. The applicant proposes to manage this aging process through the use of its One-Time Inspection Program. The GALL Report recommends that this aging process be managed through the use of GALL AMP XI.M20, "Open Cycle Cooling Water System." The proposed AMP is not consistent with the AMP proposed by the GALL Report. As a result, the applicant proposes that the AMR item 3.4.1-32 is consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited (LRA Note E).

In its review of LRA item 3.4.1-32, the staff noted that the One-Time Inspection Program is designed to be used when the environment to which a system, structure, or component is exposed is invariant with time, (e.g., treated water systems where the water chemistry is frequently monitored and carefully controlled). In such systems, the lack of prior corrosion may be an indicator that future corrosion will not occur. Raw water systems cannot be considered to be invariant with time in terms of chemistry or microbiology. Since stainless steel is highly susceptible to microbiological corrosion and since microbiological corrosion can occur rapidly, the absence of past corrosion cannot be considered a reliable predictor of future corrosion. The staff also notes that the structures, systems, and components under consideration appear to be subject to GL 89-13 and that a one-time inspection of these components appears to be inconsistent with the requirements of the GL 89-13.

By letter dated June 29, 2009, the staff issued RAI 3.4.2.1-3 requesting that the applicant propose a program to manage the aging of the components under consideration which is consistent with GL 89-13, which recognizes the variability of the chemistry and microbiology of raw water, and which acknowledges the inability to use past corrosion performance as an indicator of future corrosion under such circumstances.

In its response dated July 29, 2009, the applicant stated that the only component under consideration is a piece of nonsafety-related stainless steel tubing with a diameter of less than

½ inch. The applicant also stated that this tubing is not subject to GL 89-13. The applicant further indicated that this tubing is in-scope for license renewal only due to its potential to impact safety related equipment through spray or leakage, and that this potential is quite low due to the small size and low pressure of the tubing. Lastly, the applicant indicated that there is no history of corrosion of stainless steel tubing by Missouri River water. The staff finds the applicant's currently proposed AMP acceptable for two reasons. First, GL 89-13 does not apply, which negates the need for testing other than to detect corrosion; and second, the low consequences of failure of this component coupled with the theoretical and OE demonstrated corrosion resistance of stainless steel to river water, coupled with a one-time inspection, provide assurance that the component will perform its intended function.

The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.4.2.1.5 Loss of Material Due to Pitting and Crevice Corrosion for Stainless Steel Components Exposed to Steam.

LRA Table 3.4.1, item 3.4.1-37 addresses loss of material due to pitting and crevice corrosion for stainless steel piping, piping components, and piping elements exposed to steam in the Auxiliary Steam System.

The LRA credits Water Chemistry Control – Auxiliary Systems Program to manage this aging effect for stainless steel piping, piping components, and piping elements in steam (internal) environment only. The GALL Report recommends GALL AMP XI.M2, "Water Chemistry" to manage this aging effect. The AMR line items that reference this line item cite LRA Note E, indicating that the AMR line items are consistent with GALL Report material, environment, and aging effect, but a different AMP is credited. The applicant indicated that the steam is produced from treated water that is controlled by Water Chemistry Control – Auxiliary Systems Program. The staff noted that as defined by the GALL Report, the environment of steam is subject to the BWR Water Chemistry Program. The staff further noted that this environment does not directly correspond to the GALL Report definition of steam because it is controlled by the applicant's Auxiliary System Water Chemistry Program and not its BWR Water Chemistry Program.

The staff noted that the applicant referenced this GALL AMR line item because it was the same material and aging effect combination; however, these systems are not associated with those systems that are controlled by the Water Chemistry Control – BWR Program. Therefore, it is not appropriate to credit the Water Chemistry Control – BWR Program for aging management. By letter dated June 15, 2009, the applicant indicated that based on the design of the AS system electric boiler, a high level of water conductivity is required. The applicant further indicated that this high level of water conductivity propagates the electric arc generated by the boiler coil. The staff noted that because of the design and requirements of these electric boilers the system is not suitable to be controlled by the EPRI guidelines for BWR water chemistry referenced by the GALL Report. The applicant indicated that the design of the chilled water portion of the HV system have requirements on the parameters monitored to reflect the design of the components, such that the EPRI guidelines are not suitable for these systems. The staff noted that the monitored parameters, and acceptance criteria for these parameters, are based on manufacturer's recommendations.

The staff reviewed the applicant's Water Chemistry Control – Auxiliary Systems Program and its evaluation is documented in SER Section 3.0.3. The staff noted that this program consists of sampling and analysis of water from these systems in order to minimize the exposure of an aggressive environment that may lead to loss of material and cracking. The staff further noted that this program includes certain acceptance criteria in accordance with industry guidelines such as pH, conductivity, phosphate, sulfite, and iron in the Auxiliary Steam System. Furthermore, the staff noted that the applicant is conservatively performing a one-time inspection of a sample of components most susceptible to this aging effect to verify the effectiveness of the Water Chemistry Control – Auxiliary Systems Program. The staff noted these AMR line items did not explicitly credit the One-Time Inspection Program because it is integrated into the Water Chemistry Control – Auxiliary Systems Program, and the staff finds this to be acceptable. The staff determined that maintaining water chemistry in these systems will be capable of mitigating loss of material and cracking and that the one-time inspection is conservative and will provide verification of the program's effectiveness.

Based on the programs identified, the staff determines that the applicant's proposed programs are acceptable for managing the aging effect in the applicable components. The staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 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

In LRA Section 3.4.2.2, the applicant further evaluates aging management, as recommended by the GALL Report, for the S&PC systems components, and provides information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to general, pitting, and crevice corrosion
- loss of material due to general, pitting, crevice, and MIC and fouling
- reduction of heat transfer due to fouling
- loss of material due to general, pitting, crevice, and MIC
- cracking due to SCC
- loss of material due to pitting and crevice corrosion
- loss of material due to pitting, crevice, and MIC
- loss of material due to general, pitting, crevice, and galvanic corrosion
- QA for aging management of nonsafety-related components

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which the report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.4.2.2. The staff's selective review of the applicant's further evaluation is provided in the following sections.

3.4.2.2.1 Cumulative Fatigue Damage for Steam and Power Conversion Systems

LRA Section 3.4.2.2.1 states that metal fatigue in S&PC systems is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). The applicant indicated that evaluation of this TLAA is addressed in LRA Section 4.3. However, it is unclear to the staff whether LRA Section 4.3 has covered the fatigue TLAA for the components under the SPC, as the applicant claimed. The staff issued RAI 3.1-2 in a letter dated June 29, 2009, requesting the applicant to list the components that have the TLAA evaluated for SPC. The applicant's response to RAI 3.1-2 is acceptable.

In reviewing LRA Table 3.4.2-1 through Table 3.4.2-12, the staff found that the applicant identified 71 items subjecting to metal fatigue TLAA. Of these, 52 are consistent with the GALL Report, as identified by referencing LRA Notes A and C, whereas the remaining 19 items are cited with LRA Note H, which indicates that the aging effect is not addressed in the GALL Report for the indicated component-material-environment combination.

The staff verified that in LRA Section 4.3 the applicant provided its TLAA evaluation for these components. The staff's evaluation of these TLAAs is documented in SER Section 4.3.2.

Based on 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 functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.4.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion of Steel Piping, Piping Components, and Piping Elements Exposed to Steam.

LRA Section 3.4.2.2.2, item 1 addresses loss of material due to general, pitting and crevice corrosion for carbon steel piping and piping components and tanks exposed to treated water and for carbon steel piping and components exposed to steam in the S&PC and other systems. The applicant indicated that it will manage this aging through use of its Water Chemistry Control – BWR Program (evaluated in SER Section 3.0.3). For other systems with controlled water chemistry, the applicant indicated that it will manage loss of material for steel components exposed to steam using its Water Chemistry Control – Auxiliary Systems Program to manage the aging effect. The effectiveness of these water chemistry control programs will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting these programs, including susceptible locations such as areas of stagnant flow.

The staff reviewed LRA Section 3.4.2.2.2, item 1 against the criteria in SRP-LR Section 3.4.2.2.2, item 1 which states that loss of material due to general, pitting and crevice corrosion could occur for steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water and for steel piping, piping components, and piping elements exposed to steam. The GALL Report states that the existing AMP (Water Chemistry (GALL AMP XI.M2)) relies on monitoring and control of water chemistry to manage the effects of loss of material due to general, pitting, and crevice corrosion. The GALL Report also states that control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations of stagnant flow conditions. The GALL Report further states that the effectiveness of the Water Chemistry Control Program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of the water chemistry control program. The GALL Report states a one-time inspection (GALL AMP XI.M32) of select components and susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The staff notes that in LRA Section 3.4.2.2.2, item 1, the applicant has identified appropriate AMPs and has identified the critical conditions requiring further review (i.e., the potential for water chemistry control to be ineffective in stagnant areas). The staff finds that LRA Section 3.4.2.2.2, item 1 is consistent with SRP-LR Section 3.4.2.2.2, item 1.

The staff also reviewed AMR items subordinate to LRA Table 3.4.1, items 3.4.1-2, 3.4.1-4, and 3.4.1-6 which are associated with LRA Section 3.4.2.2.2, item 1. In this review the staff noted that the applicant proposes that the components associated with LRA items 3.4.1-2, 3.4.1-4, and 3.4.1-6 are either fully consistent with the GALL Report, are consistent with the GALL Report in all respects except the component is different, or are consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited.

In its review of components subordinate to LRA Table items 3.4.1-2, 3.4.1-4, and 3.4.1-6, for which the applicant assigned LRA Note A, the staff concurs with the applicant that these items are, in fact, consistent with the GALL Report. As described in SRP-LR Section 3.01, items which are consistent with the GALL Report are acceptable for license renewal.

In its review of components subordinate to LRA Table items 3.4.1-2, 3.4.1-4, and 3.4.1-6, for which the applicant assigned LRA Note C, the staff noted that the components listed do not meet the precise definition of the GALL Report; however, the staff also noted that the corrosion mechanisms and rates expected in these components are similar to those expected for the components listed in the GALL Report and that the same AMP could be effectively employed. The staff accepts that the components under consideration are sufficiently similar to those actually included in SRP-LR Table 3.4.1, IDs 2, 4, and 6 so as not to render them inconsistent with the GALL Report. As described in SRP-LR Section 3.0.1, items which are consistent with the GALL Report are acceptable for license renewal.

In its review of components subordinate to LRA Table items 3.4.1-2, 3.4.1-4, and 3.4.1-6, for which the applicant assigned LRA Note E, the staff noted that the applicant's AMP "Water Chemistry Control – Auxiliary Systems" is similar in intent and scope to the GALL Report AMP "Water Chemistry Control – BWR." The primary difference between the two programs is the target water chemistry. Since industry guidelines (e.g., ASME and American Boiler Manufacturers Association) for water chemistry vary with boiler pressure and type, the staff considers it reasonable for the applicant to propose water chemistry values consistent with the boiler type and pressure used for the auxiliary systems.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.2, item 1 criteria. For those line items that apply to LRA Section 3.4.2.2.2, item 1, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3)

LRA Section 3.4.2.2.2, item 2 addresses loss of material due to general, pitting and crevice corrosion that may occur in piping, piping components, and piping elements. The applicant indicated that loss of material for steel components exposed to lubricating oil is managed by the Oil Analysis Program. The Oil Analysis Program manages aging effects through periodic monitoring and control of contaminants, thus preserving an environment that is not conducive to corrosion. The applicant further indicated that the One-Time Inspection Program will provide a verification of the effectiveness of the Oil Analysis Program to manage loss of material due to general, pitting, and crevice corrosion through examination of steel components.

SRP-LR Section 3.4.2.2.2, item 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 program periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always 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 programs. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the applicant's Oil Analysis Program and One-Time Inspection Program and its evaluations are documented in SER Section 3.0.3, respectively. The staff determined that the Oil Analysis Program includes periodic sampling and analysis of lubricating oil to determine if contaminants, particulates and water are present. The staff noted that the presence of these impurities in the lubricating oil can create an environment that is conducive to age-related degradation such as loss of material, cracking and fouling. The staff determined that the activities performed as part of this program will be capable of preserving an environment that will not promote loss of material, cracking and fouling. The staff finds that these activities are consistent with the recommendations in the GALL Report and are adequate to manage loss of material due to general, pitting and crevice corrosion in steel piping, piping components, and piping elements exposed to lubricating oil. The staff verified that the applicant has credited its One-Time Inspection Program, which includes a one-time inspection of selected components at susceptible locations, to verify the effectiveness of the Oil Analysis Program to manage this aging effect. On the basis that the applicant's AMPs are consistent with those recommended in SRP-LR Section 3.4.2.2.2, item 2, the staff finds the applicant's use of the Oil Analysis Program and One-Time Inspection Program acceptable.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.2, item 2 criteria. For those line items that apply to LRA Section 3.4.2.2.2, item 2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.4.2.2.3 Loss of Material Due to General, Pitting, and Crevice, and Microbiologically-influenced Corrosion (MIC), and Fouling

LRA Section 3.4.2.2.3 addresses loss of material due to general, pitting, crevice, and MIC, and fouling in steel piping and components in the S&PC systems exposed to raw water. The applicant indicated that it will manage this aging through the use of its PSPM Program (reviewed in SER Section 3.0.3). The applicant stated that this program uses periodic visual inspections to manage loss of material of the components. The applicant also stated that these inspections will manage the aging effect of loss of material such that the intended function of the components will not be affected.

The staff reviewed LRA Section 3.4.2.2.3 against the criteria in SRP-LR Section 3.4.2.2.3 which states that loss of material due to general, pitting, crevice, and MIC and fouling could occur in steel piping, piping components, and piping elements exposed to raw water. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed. The GALL Report states that acceptance criteria are described in BTP RLSB-1 (Appendix A.1 of the SRP-LR.)

In its review of LRA Section 3.4.2.2.3 the staff also reviewed items subordinate to LRA Table 3.4.1, item 3.4.1-8 which is associated with LRA Section 3.4.2.2, item 3. In that review the staff noted that the applicant proposes that the AMR items associated with item 3.4.1-8 are consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited. The staff noted that the components under consideration are part of the CW system. The staff also noted that the GALL Report recommends a plant-specific AMP because at least most of the CW system is not within the scope of the GALL AMP, "Open Cycle Cooling Water." The staff further noted that the materials and environments currently under consideration are substantially similar if not identical to the materials and environments for which the recommended AMP is the Open Cycle Cooling Water Program. The staff concludes that an appropriate AMP for this service would include most of the key points included in the Open Cycle Cooling Water Program. Lastly, the staff noted that the proposed program is only a visual inspection program.

By letter dated July 14, 2009, the staff issued RAI 3.4.2.2.3-1 requesting that the applicant proposes an AMP which is substantially consistent with the Open Cycle Cooling Water Program, or justify how the proposed program will adequately manage internal corrosion of the components under consideration.

The applicant responded by letter dated August 13, 2009. In its response, the applicant correctly stated that the aging effect listed in the GALL item under consideration is loss of material. Loss of material due to the mechanisms listed in this GALL item can be detected by visual examinations. Both the Open Cycle Cooling Water Program and the applicant's PSPM Program contain provisions for visual inspection. Other tests included in the Open Cycle Cooling Water Program are not applicable to the detection of loss of material as required by this GALL item. The staff finds the applicant's currently proposed AMP acceptable because the program contains appropriate inspection techniques to detect the aging effect under consideration.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.3 criteria. For those line items that apply to LRA Section 3.4.2.2.3, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3)

3.4.2.2.4 Reduction in Heat Transfer Due to Fouling

LRA Section 3.4.2.2.4, item 1 addresses reduction of heat transfer due to fouling for stainless steel and copper alloy heat exchanger tubes exposed to treated water. The applicant indicated that, although the S&PC systems at CNS have no components in this environment associated with this aging effect, the reduction of heat transfer for copper alloy heat exchanger tubes in the HPCI and RCIC systems is managed by the Water Chemistry Control – BWR Program. The applicant noted 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, which includes susceptible locations such as areas of stagnant flow.

SRP-LR Section 3.4.2.2.4, item 1 states reduction of heat transfer due to fouling may occur in stainless steel and copper alloy heat exchanger tubes exposed to treated water, and that management of this aging effect relies on water chemistry control. However, since control of water chemistry may have been inadequate, the GALL Report recommends that the effectiveness of the chemistry control program be verified to ensure that reduction of heat transfer due to fouling is not occurring. A one-time inspection is noted as an acceptable method to ensure that reduction of heat transfer is not occurring and that components' intended functions will be maintained during the period of extended operation. The staff noted the discussion in GALL AMP XI.M2, "Water Chemistry," relative to water chemistry programs being generally effective in removing impurities, except in low flow or stagnant flow areas.

The staff evaluated the applicant's Water Chemistry Control – BWR Program and One-Time Inspection Program in SER Section 3.0.3 and determined that both programs were acceptable. The staff determined that the Water Chemistry Control – BWR Program was consistent with the program elements of GALL AMP XI.M2 and noted that the program relies on monitoring and controlling water chemistry based on EPRI Report 1008192. The staff considers that the activities performed as part of this program will be capable of preserving an environment that does not promote fouling. The staff also verified that the applicant will use its One-Time Inspection Program to verify the effectiveness of the Water Chemistry Control - BWR Program, which will include a one-time inspection of selected components at susceptible locations, to ensure no significant fouling is occurring in ESF systems. The staff finds the applicant's use of the Water Chemistry Control - BWR Program, combined with the One-Time Inspection Program, is acceptable to manage the reduction of heat transfer due to fouling, because these AMPs are the recommended programs in SRP-LR Section 3.4.2.2.4, item 1.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.4, item 1 criteria. For those line items that apply to LRA Section 3.4.2.2.4, item 1, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

LRA Section 3.4.2.2.4, item 2 addresses the reduction of heat transfer due to fouling for steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil. The applicant indicated that, although the S&PC systems at CNS have no components in this environment associated with this aging effect, the reduction of heat transfer for stainless steel and copper alloy heat exchanger tubes exposed to lubricating oil in the DG system is managed by the Oil Analysis Program. The applicant also indicated that this program includes periodic sampling and analysis to maintain contaminants levels in the lubricating oil within acceptable limits, thereby preserving an environment that is not conducive to fouling. The applicant further indicated that the One-Time Inspection Program will confirm that the Oil Analysis Program has been effective at managing the loss of heat transfer due to fouling by using visual inspections or non-destructive examinations of representative samples of components crediting this program.

SRP-LR Section 3.4.2.2.4, item 2 states that loss of heat transfer due to fouling could occur for steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil. The existing AMP relies on monitoring and control of lube oil chemistry to mitigate reduction of heat transfer due to fouling. However, control of lube oil 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 programs and notes that a one-time inspection of selected components at susceptible locations is an acceptable method for determining that this aging effect is not occurring.

The staff evaluated the applicant's Oil Analysis and One-Time Inspection programs in SER Section 3.0.3 and determined that both programs were acceptable. The staff noted that the Oil Analysis Program includes periodic sampling and analysis of lubricating oil to determine if contaminants, particulates and water are present. The staff noted that the presence of these impurities in the lubricating oil can create an environment that is conducive to age-related degradation including fouling. The staff determined that the activities performed as part of this program will be capable of preserving an environment that will not promote fouling. The staff finds that these activities are consistent with the recommendations in the GALL Report, and are adequate to manage loss of heat transfer in stainless steel and copper alloy heat exchanger tubes exposed to lubricating oil. The staff also verified that the applicant will use its One-Time Inspection Program to verify the effectiveness of the Oil Analysis Program, which will include a one-time inspection of selected components at susceptible location, to manage this aging effect in auxiliary systems. The staff finds the applicant's use of the Oil Analysis and One-Time Inspection Programs are acceptable to manage the reduction of heat transfer due to fouling, because these AMPs are the recommended programs in SRP-LR Section 3.4.2.2.4, item 2.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.4, item 2 criteria. For those line items that apply to LRA Section 3.4.2.2.4, item 2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.4.2.2.5 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

<u>LRA Section 3.4.2.2.5, item 1</u> addresses loss of material due to general, pitting, and crevice corrosion and MIC which could occur in carbon steel (with or without coating or wrapping) piping, piping components, piping elements and tanks exposed to soil. The applicant indicated that the S&PC systems at CNS have no carbon steel components that are exposed to soil. The applicant also indicated that this item was not used.

The staff reviewed LRA Section 3.4.2.2.5, item 1 against the criteria in SRP-LR Section 3.4.2.2.5, item 1 which indicates that loss of material due to general, pitting, crevice, and MIC could occur in steel (with or without coating or wrapping) piping, piping components, piping elements and tanks exposed to soil. The GALL Report states that the Buried Piping and Tanks Inspection Program relies on industry practice, frequency of pipe excavation, and OE to manage the effects of loss of material from general corrosion, pitting, crevice, and MIC. The GALL Report also indicates that the effectiveness of the Buried Piping and Tanks Inspection Program should be verified to evaluate an applicant's inspection frequency and OE with buried components, ensuring that loss of material is not occurring.

In its review of LRA Section 3.4.2.2.5, item 1, the staff also reviewed items subordinate to LRA Table 3.4.1, item 3.4.1-11 which is associated with this LRA section. In its review the staff noted that there were no subordinate items to item 3.4.1-11 and a search of the applicant's USAR (power conversion systems) for "buried piping" and "buried tanks" failed to find any evidence that such piping existed.

The staff concludes that components addressed by this AMR item do not exist at CNS and that this item is not applicable.

<u>LRA Section 3.4.2.2.5, item 2</u> addresses loss of material due to general, pitting, crevice, and MIC that may occur in heat exchanger components. The applicant indicated that loss of material for carbon steel components exposed to lubricating oil is managed by the Oil Analysis Program. The Oil Analysis Program manages aging effects through periodic monitoring and control of contaminants, thus preserving an environment that is not conducive to corrosion. The applicant

further indicated that the One-Time Inspection Program will provide a verification of the effectiveness of the Oil Analysis Program to manage loss of material due to general, pitting, crevice, and MIC through examination of carbon steel components.

SRP-LR Section 3.4.2.2.5, item 2 indicates that loss of material due to general, pitting, crevice, micro-biologically-influenced corrosion may occur in steel heat exchanger components exposed to lubricating oil. The existing program periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always 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 programs. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the applicant’s Oil Analysis Program and One-Time Inspection Program and its evaluations are documented in SER Section 3.0.3. The staff determined that the Oil Analysis Program includes periodic sampling and analysis of lubricating oil to determine if contaminants, particulates and water are present. The staff noted that the presence of these impurities in the lubricating oil can create an environment that is conducive to age-related degradation such as loss of material, cracking and fouling. The staff determined that the activities performed as part of this program will be capable of preserving an environment that will not promote loss of material, cracking and fouling. The staff finds that these activities are consistent with the recommendations in the GALL Report and are adequate to manage loss of material due to general, pitting, crevice, micro-biologically-influenced corrosion in steel heat exchanger components exposed to lubricating oil. The staff verified that the applicant has credited its One-Time Inspection Program, which includes a one-time inspection of selected components at susceptible locations, to verify the effectiveness of the Oil Analysis Program to manage this aging effect. On the basis that the applicant’s AMPs are consistent with those recommended in SRP-LR Section 3.4.2.2.5, item 2, the staff finds the applicant's use of the Oil Analysis Program and One-Time Inspection Program acceptable.

Based on the programs identified above, the staff concludes that the applicant’s programs meet SRP-LR Section 3.4.2.2.5, item 2 criteria. For those line items that apply to LRA Section 3.4.2.2.5, item 2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.4.2.2.6 Cracking Due to Stress-Corrosion Cracking

LRA Section 3.4.2.2.6 addresses cracking due to SCC in the S&PC system. The applicant indicated that the cracking due to SCC in the stainless steel piping, piping elements, and piping components of the S&PC system, which are exposed to steam or treated water greater than 140 °F, is managed by the Water Chemistry Control – BWR Program. The applicant also indicated that the cracking due to SCC in the stainless steel components of the other systems exposed to steam is managed by the Water Chemistry Control – Auxiliary Systems Program.

In LRA Section 3.4.2.2.6 and Table 3.4.1, items 3.4.1-13 and 3.4.1-14, the applicant further indicated that the One-Time Inspection Program will verify the effectiveness of the water chemistry control programs through an inspection of a representative sample of components crediting the water chemistry control programs, including susceptible locations such as areas of stagnant flow. The staff reviewed LRA Section 3.4.2.2.6 against the criteria in SRP-LR Section 3.4.2.2.6, which states that the effectiveness of the Water Chemistry Control Program should be verified to ensure that SCC is not occurring and a one-time inspection of selected components at susceptible locations is an acceptable method to ensure that SCC is not occurring and that the component's intended function will be maintained during the period of extended operation.

The staff reviewed LRA Table 3.4.1, items 3.4.1-13 and 3.4.1-14 in comparison with SRP-LR Table 3.4-1, IDs 13 and 14, respectively. The staff also reviewed the AMR results of the LRA in comparison with GALL Report, Volume 2, Tables VIII.A (item VIII.A-11), VIII.B2 (item VIII.B2-1), and VIII.E (items VIII.E-31 and VIII.E-38). The detailed evaluation results are described in the following paragraphs.

In its review of LRA Tables 3.4.2-1 and 3.4.2-2, the staff found that the AMR results regarding further evaluation of SCC were adequate as the applicant identified relevant AMR items for SCC of stainless steel components in the S&PC system. The staff found that the Water Chemistry Control – BWR Program is used to manage the SCC in conjunction with the One-Time Inspection Program in accordance with the SRP-LR.

The staff also found that LRA Table 3.2.2-8 addressed AMR items for the ESFs in connection with LRA item 3.4.1-13. The LRA Note of the items was C, which means that the component is different, but the item is consistent with the GALL Report item for material, environment, aging effect, and AMP. The staff found that the applicant indicated that the SCC aging effect of the AMR items is managed by the same aging management method that credits Water Chemistry Control – BWR Program in conjunction with the One-Time Inspection Program. The staff found that the AMR results and aging management method are adequate and acceptable in accordance with the SRP-LR and the GALL Report.

As part of its AMP review, the staff also reviewed the Water Chemistry Control – BWR Program and One-Time Inspection Program of the applicant. The review results of the AMPs are documented in SER Section 3.0.3. The staff finds that the Water Chemistry Control – BWR Program is adequate to manage SCC in the S&PC system on the basis that the One-Time Inspection Program will be used to verify the effectiveness of the Water Chemistry Control Program. In its review, the staff finds the Water Chemistry Control Program is capable of mitigating the aging effects of cracking that can be caused by SCC. The staff also finds that this program controls water chemistry to minimize the environmental degradation of the components by maintaining the relevant water chemistry and limiting the levels of contaminants such as chloride and sulfate in the S&PC system that may cause cracking. The staff finds that the One-Time Inspection Program, which performs inspections of selected components, including the areas of low or stagnant flow, is capable of detecting cracking and loss of material due to general, pitting, and crevice corrosion, if it should occur in the selected components. The staff also finds that the One-Time Inspection Program is adequate to verify whether the aging effects of SCC are not occurring such that the intended functions of the components are maintained during the extended period of operation.

The staff also noted that two AMR items (tubing and valve body or GALL Report, item SP-45) in LRA Table 3.3.2-14-2 for the AS system credited the Water Chemistry Control - Auxiliary Systems Program to manage SCC in a steam environment. The staff found that similar to the aging management method for LRA Table 3.4.1, item 3.4.1-13, the applicant indicated that the effectiveness of the Water Chemistry Control Program will also be verified by the One-Time Inspection Program. The staff reviewed the Water Chemistry Control – Auxiliary Systems Program and the review results of the AMP are documented in SER Section 3.0.3. The staff finds that the Water Chemistry Control–Auxiliary Systems Program is adequate to manage SCC for the AMR items of the AS system on the basis that the One-Time Inspection Program will be used to verify the effectiveness of the Water Chemistry Control Program as stated in the SRP-LR and similarly described in the foregoing paragraph as part of the SE for the AMR items of the S&PC system.

Based on the programs identified and its review results, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.6 criteria. For those AMR items that apply to LRA Section 3.4.2.2.6, the staff determines that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effect of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.4.2.2.7 Loss of Material Due to General (Steel Only), Pitting, and Crevice Corrosion.

LRA Section 3.4.2.2.7, item 1 addresses loss of material due to pitting and crevice corrosion for aluminum, copper alloy, and stainless steel components exposed to treated water. The applicant indicated that it would manage this aging through the use of its Water Chemistry Control – BWR Program (reviewed in SER Section 3.0.3). 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 susceptible locations such as areas of stagnant flow.

The staff reviewed LRA Section 3.4.2.2.7, item 1 against the criteria in SRP-LR Section 3.4.2.2.7, item 1, which states loss of material due to pitting and crevice corrosion could occur for stainless steel, aluminum, and copper alloy piping, piping components and piping elements and for stainless steel tanks and heat exchanger components exposed to treated water. The GALL Report states that the existing AMP (GALL AMP XI.M2, "Water Chemistry") relies on monitoring and control of water chemistry to manage the effects of loss of material due to pitting, and crevice corrosion. The GALL Report also states that control of water chemistry does not preclude corrosion at locations of stagnant flow conditions. Therefore, the GALL Report recommends that the effectiveness of the Water Chemistry Control Program should be verified to ensure that corrosion is not occurring. The GALL Report states that a one-time inspection of select components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The staff notes that in LRA Section 3.4.2.2.7, item 1, the applicant has identified appropriate AMPs and has identified the critical conditions requiring further review(i.e., the potential for water chemistry control to be ineffective in stagnant areas). The staff finds that LRA Section 3.4.2.2.7, item 1 is consistent with SRP-LR Section 3.4.2.2.7, item 1.

The staff also reviewed AMR items subordinate to LRA Table 3.4.1 (items 3.4.1-6, 3.4.1-15, and 3.4.1-16) which is associated with LRA Section 3.4.2.2.7, item 1. In this review the staff noted that the applicant proposes that the components associated with LRA items 3.4.1-6, 3.4.1-15, and 3.4.1-16 are either fully consistent with the GALL Report or are consistent with the GALL Report in all respects, except the component is different.

In its review of components subordinate to LRA table 3.4.1 (3.4.1-6, 3.4.1-15, and 3.4.1-16), for which the applicant assigned LRA Note A, the staff concurs with the applicant that these items are, in fact, consistent with the GALL Report. As described in SRP-LR, items which are consistent with the GALL Report are acceptable for license renewal.

In its review of components subordinate to LRA Table 3.4.1 (3.4.1-6, 3.4.1-15, and 3.4.1-16), for which the applicant assigned LRA Note C, the staff noted that the components listed do not meet the precise definition of the GALL Report. However, the staff also noted that the corrosion mechanisms and rates expected in these components are similar to those expected for the components listed in the GALL Report and that the same AMP could be effectively employed. The staff accepts that the components under consideration are sufficiently similar to those actually included in SRP-LR Table 3.4.1, IDs 6, 15, and 16 so as not to render them inconsistent with the GALL Report. As described in SRP-LR section, items which are consistent with the GALL Report are acceptable for license renewal.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.7, item 1 criteria. For those line items that apply to LRA Section 3.4.2.2.7, item 1, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

LRA Section 3.4.2.2.7, item 2 addresses loss of material from pitting and crevice corrosion which could occur in stainless steel piping and piping components exposed to a soil environment. The applicant indicated that the S&PC systems at CNS have no stainless steel components that are exposed to soil. The applicant also indicated that this item was not used.

The staff reviewed LRA Section 3.4.2.2.7, item 2 against the criteria in SRP-LR Section 3.4.2.2.7, item 2 which states that loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements exposed to soil. The GALL Report recommends further evaluation of a plant-specific aging management to ensure that this aging effect is adequately managed. The GALL Report states that acceptance criteria are described in BTP RLSB-1 (Appendix A.1 of this SRP-LR.)

In its review of LRA Section 3.4.2.2.7, item 2, the staff also reviewed items subordinate to LRA Table 3.4.1, item 3.4.1-17 which is associated with this LRA section. In its review the staff noted that answers to staff's inquires during the AMP audit also indicated no buried stainless steel piping was present. The staff also noted that search of the applicant's USAR (power conversion systems) for "stainless steel" failed to find any evidence that such piping existed.

The staff concludes that the components addressed by this AMR item do not exist and that this item is not applicable.

LRA Section 3.4.2.2.7, item 3 addresses loss of material due to pitting and crevice corrosion that may occur in piping, piping components and piping elements. The applicant indicated that loss of material for copper alloy components exposed to lubricating oil is managed by the Oil Analysis Program. The Oil Analysis Program manages aging effects through periodic monitoring and control of contaminants, thus preserving an environment that is not conducive to corrosion. The applicant further indicated that the One-Time Inspection Program will provide a verification of the effectiveness of the Oil Analysis Program to manage loss of material due to pitting and crevice corrosion through examination of copper alloy components.

SRP-LR Section 3.4.2.2.7, item 3 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 program periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always 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 programs. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the applicant's Oil Analysis Program and One-Time Inspection Program and its evaluations are documented in SER Section 3.0.3. The staff determined that the Oil Analysis Program includes periodic sampling and analysis of lubricating oil to determine if contaminants, particulates and water are present. The staff noted that the presence of these impurities in the lubricating oil can create an environment that is conducive to age-related degradation such as loss of material, cracking and fouling. The staff determined that the activities performed as part of this program will be capable of preserving an environment that will not promote loss of material, cracking and fouling. The staff finds that these activities are consistent with the recommendations in the GALL Report and are adequate to manage loss of material due to pitting and crevice corrosion in copper alloy piping, piping components, and piping elements exposed to lubricating oil. The staff verified that the applicant has credited its One-Time Inspection Program, which includes a one-time inspection of selected components at susceptible locations, to verify the effectiveness of the Oil Analysis Program to manage this aging effect. On the basis that the applicant's AMPs are consistent with those recommended in SRP-LR Section 3.4.2.2.7, item 3, the staff finds the applicant's use of the Oil Analysis Program and One-Time Inspection Program acceptable.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.7, item 3 criteria. For those line items that apply to LRA Section 3.4.2.2.7, item 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 functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.4.2.2.8 Loss of Material Due to Pitting, Crevice, and Microbiologically Influenced Corrosion

LRA Section 3.4.2.2.8 addresses loss of material due to pitting, crevice, and MIC that may occur in piping, piping components, and piping elements and heat exchanger components. The applicant indicated that loss of material for stainless steel components exposed to lubricating oil is managed by the Oil Analysis Program. The Oil Analysis Program manages aging effects through periodic monitoring and control of contaminants, thus preserving an environment that is not conducive to corrosion. The applicant further stated that the One-Time Inspection Program will provide a verification of the effectiveness of the Oil Analysis Program to manage loss of material due to pitting, crevice, and MIC through examination of stainless steel components.

SRP-LR Section 3.4.2.2.8 states that loss of material due to pitting, crevice, and MIC may occur in stainless steel piping, piping components and piping elements and heat exchanger components exposed to lubricating oil. The existing program periodically samples and analyzes lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always 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 programs. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that component intended functions will be maintained during the period of extended operation.

The staff reviewed the applicant’s Oil Analysis Program and One-Time Inspection Program and its evaluations are documented in SER Section 3.0.3. The staff determined that the Oil Analysis Program includes periodic sampling and analysis of lubricating oil to determine if contaminants, particulates, and water are present. The staff noted that the presence of these impurities in the lubricating oil can create an environment that is conducive to age-related degradation such as loss of material, cracking, and fouling. The staff determined that the activities performed as part of this program will be capable of preserving an environment that will not promote loss of material, cracking, and fouling. The staff finds that these activities are consistent with the recommendations in the GALL Report and are adequate to manage loss of material due to pitting, crevice, and MIC in stainless steel piping, piping components, and piping elements and heat exchanger components exposed to lubricating oil. The staff verified that the applicant has credited its One-Time Inspection Program, which includes a one-time inspection of selected components at susceptible locations, to verify the effectiveness of the Oil Analysis Program to manage this aging effect. On the basis that the applicant’s AMPs are consistent with those recommended in SRP-LR Section 3.4.2.2.8, the staff finds the applicant's use of the Oil Analysis Program and One-Time Inspection Program acceptable.

Based on the programs identified above, the staff concludes that the applicant’s programs meet SRP-LR Section 3.4.2.2.8 criteria. For those line items that apply to LRA Section 3.4.2.2.8, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.4.2.2.9 Loss of Material due to General, Pitting, Crevice, and Galvanic Corrosion

LRA Section 3.4.2.2.9 addresses the loss of material due to general, pitting, crevice, and galvanic corrosion for steel heat exchanger components exposed to treated water in the S&PC systems. The applicant stated that this aging effect for these components is managed by its Water Chemistry Control-BWR Program, and that the effectiveness of this program will be confirmed by the One-Time Inspection Program. The applicant continued by stating that verification is through inspections of a representative sample of components, which will include susceptible locations such as 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 may occur in steel heat exchanger components exposed to treated water, and notes that the existing AMP relies on monitoring and control of water chemistry to manage these aging mechanisms. The SRP-LR notes, however, that control of water chemistry does not preclude these aging mechanisms from occurring at locations with stagnant conditions, that the effectiveness of the chemistry program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of the programs to verify the effectiveness of the water chemistry program, and states that a one-time inspection of selected components at susceptible locations is an acceptable method.

The staff reviewed the applicant’s Water Chemistry Control-BWR Program and One-Time Inspection Program in SER Section 3.0.3. The staff determined that these programs include activities that are consistent with recommendations in the GALL Report. Based on this, these programs are adequate to manage the loss of material due to general, pitting, crevice, and galvanic corrosion, because the Water Chemistry Control-BWR Program limits the level of contaminants to minimize the potential for corrosion and the One-Time Inspection Program verifies the effectiveness of AMPs, including the Water Chemistry Control-BWR Program.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.9 criteria. 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 that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.10 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA program.

3.4.2.3 AMR Results That Are Not Consistent with or Not Addressed in the GALL Report

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. 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 functions will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.4.2.3.1 Managing Aging of the Condenser for Carbon Steel, Copper Alloy, and Stainless Steel Components Exposed to Air (indoor), Raw Water, Treated Water, and Steam

LRA Table 3.4.2-1 addresses the corrosion of condenser components fabricated from carbon steel, cooper alloy, and stainless steel components which are exposed to air (indoor), raw water, treated water, and steam. The intended function of the condenser of significance to license renewal is proposed to be plateout (provide holdup and plateout of fission products). The applicant proposes that, for the intended function of plateout, there is no aging effect and that no AMP is required. In a footnote to the LRA, the applicant provided the following information:

> 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.

The staff agrees with the applicant's determination that the main condenser does not have to be leak-tight and the post-accident conditions in the main condenser are essentially atmospheric. The staff noted during normal plant operations, condenser vacuum is continuously monitored, which verifies the integrity of the main condenser. The staff further noted if the integrity of the main condenser were to degrade to a point where a loss of vacuum occurred, this would require placing the plant in a mode where the intended function would be obviated. 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. Therefore, acceptable performance during normal plant operation provides adequate assurance that the main condenser can perform the holdup and plate-out post-accident function. Previous reviews by the staff have also documented similar findings where plateout was defined as the intended function for other facilities.

On the basis of its review, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.4.2.3.2 Copper Alloy Exposed to Steam (Internal)

The applicant indicated in LRA Table 3.4.2-2-9 (MS system) that the loss of material for valve bodies fabricated from copper alloy greater than 15 percent Zn or 8 percent Al exposed to steam (internal) will be managed using the Water Chemistry Control – BWR Program. The AMR line items cite LRA Note G, which indicates that the environment is not addressed in the GALL Report for this component and material combination.

The LRA defines steam as "treated water that has been converted to steam." The staff noted that copper alloy greater than 15 percent Zn or greater than 8 percent Al exposed to treated water is susceptible to loss of material due to selective leaching. The staff noted that the applicant only credited the Water Chemistry Control – BWR Program for aging management. Therefore, by letter dated June 29, 2009, the staff issued RAI 3.4-1 requesting the applicant clarify if this material and environment combination is susceptible to loss of material due to selective leaching. The staff also requested the applicant justify the Water Chemistry Control – BWR Program's ability for aging management without being augmented by a one-time inspection, whether it is the Selective Leaching Program or the One-Time Inspection Program. The applicant responded to the staff's RAI by letter dated July 29, 2009, by stating that copper alloy greater than 15 percent Zn or greater than 8 percent Al valve body components that are exposed to a steam (internal) environment are susceptible to loss of material due to selective leaching. The staff confirmed the applicant amended LRA Table 3.4.2.2-9 to state that copper alloy greater than 15 percent Zn or greater than 8 percent Al valve body components exposed to a steam (internal) environment has an aging effect of loss of material and has credited its Selective Leaching Program for aging management. The staff finds the applicant's response acceptable because (1) the applicant acknowledged that copper alloy greater than 15 percent Zn or greater than 8 percent Al valve body components exposed to a steam environment is susceptible to loss of material due to selective leaching and (2) the applicant has credited its Selective Leaching Program to manage this aging effect.

The staff reviewed the applicant's Water Chemistry Control – BWR Program and its evaluation is documented in SER Section 3.0.3. The staff noted that this program consists of sampling and analysis of water from these systems in order to minimize the exposure of an aggressive environment that may lead to loss of material and cracking. The staff further noted that this program includes certain acceptance criteria in accordance with industry guidelines that are referenced in the GALL Report, such as pH, conductivity, phosphate, sulfite, and iron in the AS system and the HV system. Furthermore, the staff noted that the applicant is conservatively performing a one-time inspection of a sample of components most susceptible to this aging effect to verify the effectiveness of the Water Chemistry Control – Auxiliary Systems Program. The staff noted these AMR line items did not explicitly credit the One-Time Inspection Program; however, because this one-time inspection is integrated into the Water Chemistry Control – BWR Program, the staff finds this to be acceptable. The staff reviewed the applicant's One-Time Inspection Program and its evaluation is documented in SER Section 3.0.3. The staff determined that maintaining water chemistry in these systems will be capable of mitigating loss of material and cracking and that the one-time inspection is conservative and will provide verification of the program's effectiveness.

The staff reviewed the applicant's Selective Leaching Program and its evaluation is documented in SER Section 3.0.3. The staff noted that this program consists of a one-time visual inspection supplemented by a hardness measurement or another type of industry accepted mechanical inspection technique of a selected number of sample components that may be susceptible to selective leaching. The staff determined that these activities will be capable of detecting loss of material due to selective leaching and are consistent with the recommendations in GALL AMP XI.M33, "Selective Leaching of Materials."

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 functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.4.2.3.3 Aluminum Exposed To Treated Water (Internal) and Steam (Internal)

In LRA Table 3.4.2-2-5, the applicant proposed to manage loss of material for aluminum valve bodies in a steam (internal) environment using the Water Chemistry Control-closed BWR Program for the AMR line item. The AMR line items cite LRA Note G, which indicates that the environment is not addressed in the GALL Report for this component and material.

The staff reviewed the applicant's Water Chemistry Control-BWR Program and its evaluation is documented in SER Section 3.0.3. In Appendix A.1.1.39, the Water Chemistry Control-BWR Program relies on monitoring and control of water chemistry based on EPRI Report 1008192 (BWRVIP-130). CNS has instituted HWC and NMCA to limit the potential for IGSCC through the reduction of DO in the treated water. The staff reviewed BWR water chemistry control OE from 2003 to 2005 whereby parameters were returned to the normal operating range in the required time as an effective program in managing loss of applicable components.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.4.2.3.4 Steel Bolts and Fasteners Exposed to a Condensation Environment

In LRA Table 3.4.2 2-1, the applicant proposed to manage loss of material for stainless steel bolts and fasteners externally exposed to a condensation environment using the Bolting Integrity Program. The AMR line item cites Generic Note G, which indicates that the environment is not addressed in the GALL Report for this component and material.

The LRA credits the CNS AMP B.1.2 "Bolting Integrity Program" to manage this aging effect. The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3. Stainless Steel is susceptible to a variety of aging effects and mechanisms, including loss of material. The staff verified that the Bolting Integrity Program is an existing CNS program that will manage the loss of material aging effect for stainless steel bolts and fasteners in the environment listed, in accordance with the recommendations specified by the GALL Program.

On the basis of its review, the staff finds that because these components will be inspected through the specifications of the Bolting Integrity Program, they will be adequately managed.

In LRA Table 3.4.2-2-1, the applicant proposed to manage loss of preload due to thermal effects, gasket creep, and self-loosening for carbon and stainless steel bolting and fasteners externally exposed to condensation using the Bolting Integrity Program. The AMR line items cite Plant Specific LRA Note 405, which indicates that the environments stated in the LRA for these items are considered by the applicant to be equivalent to the NUREG 1801 defined environments of air with reactor coolant leakage or air indoor (uncontrolled) for the evaluation of the loss of preload aging effect since loss of preload is not significantly dependent on environment.

The LRA credits the CNS AMP B.1.2 "Bolting Integrity Program" to manage this aging effect. The staff's evaluation of the Bolting Integrity Program is documented in SER Section 3.0.3. The Bolting Integrity Program is an existing CNS program that will manage the loss of preload through periodic inspection and preventive measures. The staff noted that the mechanisms identified in the GALL Report as causing loss of preload in carbon steel bolts are thermal effects, gasket creep, and self-loosening, which are not all dependent on the bolting material or environment. The staff also noted that activities in the Bolting Integrity program that control and manage loss of preload are effective for various bolting materials. Additionally, the staff reviewed the Bolting Integrity Program to verify that loss of preload due to thermal effects, gasket creep, and self-loosening will be managed in accordance with the recommendations specified by the Bolting Integrity Program. The staff finds that because these components will be inspected through the specifications of the Bolting Integrity Program, they will be adequately managed.

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 functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the S&PC systems components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.5 <u>Aging Management of Structures and Component Supports</u>

This section of the SER documents the staff's review of the applicant's AMR results for the structures and component supports components and component groups of the following:

- reactor building and PC
- water control structures
- turbine building, process facilities, and 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 the structures and component supports components and component groups. In LRA Table 3.5.1, “Summary of Aging Management Programs for the Structures and Component Supports,” the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the structures and component supports components and component groups.

The applicant’s AMRs incorporated applicable OE in the determination of AERMs. These reviews included evaluation of plant-specific and industry OE.

The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant’s review of industry OE included a review of the GALL Report and OE 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 supportsthat 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, in accordance with 10 CFR 54.21(a)(3).

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 relevant AMPs are documented in SER Section 3.0.3. Details of the staff’s evaluation of AMRs which are consistent with the GALL Report recommendations are documented in SER Section 3.5.2.1.

The staff also reviewed AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant’s further evaluations were consistent with the acceptance criteria in SRP-LR Section 3.5.2.2. The staff’s evaluations are documented in SER Section 3.5.2.2.

The staff also conducted a technical review of the remaining AMRs that were not consistent with, or not addressed in the GALL Report. The technical review 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 evaluations are documented in SER Section 3.5.2.3.

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 OE to verify the applicant’s claims.

In summary, the staff’s review of the containments, structures, and components supports 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 containments, structures, and components supports components is documented in SER Section 3.0.3.

3.5.2.1 AMR Results That are Consistent with the GALL Report

LRA Section 3.5.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the containments, structures, and components supports components:

- Containment Inservice Inspection (ISI) Program
- Containment Leak Rate Program
- Fire Protection Program
- Inservice Inspection (ISI) –IWF Program
- Masonry Wall Program
- Periodic Surveillance and Preventive Maintenance (PSPM) Program
- Structures Monitoring Program
- Water Chemistry Control – BWR Program
- Fire Water System Program

LRA Tables 3.5.2-1 through 3.5.2-4 summarize AMRs for the containments, structures, and components supports components and indicate AMRs claimed to be consistent with the GALL Report.

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

The staff reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluation follows.

3.5.2.1.1 AMR Results Identified as Not Applicable

In LRA Table 3.5.1, for those SSC items that the applicant indicated as does not exist at CNS, the staff reviewed the LRA and the applicant's supporting documents, and confirmed the applicant's claim that the component, material, and environment combination does not exist at CNS. Because CNS does not have the component, material, and environment combination for these items, the staff finds that the AMR requirement is not applicable for these items.

3.5.2.1.2 Cracking Due to Restraint Shrinkage, Creep, and Aggressive Environment

In the discussion section of LRA Table 3.5.1, item 3.5.1-43, for Groups 1-3, 5, and 6 masonry walls, the applicant indicated that cracking due to restraint shrinkage, creep, and aggressive environments is managed by the Masonry Wall Program. The applicant also indicated that in some cases within the reactor building, the Fire Protection Program supplements the Masonry Wall Program. The applicant further stated that for fire barrier masonry walls outside the reactor building, the Fire Protection Program manages this aging effect by periodic inspections. During the review, the staff noted that the AMP for the AMR results line that points to LRA Table 3.5.1, item 3.5.1.43, for two groups the applicant included a reference to LRA Note E, which states "the Fire Protection Program supplements the Masonry Wall Program. For fire barrier masonry walls outside the reactor building, the Fire Protection Program manages this aging effect by periodic inspections."

The staff reviewed the AMR items referenced with LRA Note E and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, whereas the GALL Report recommends AMP XI.S5, "Masonry Wall Program," the applicant has proposed using the Fire Protection Program. The applicant indicated that the AMR items that reference LRA Table 3.5.1, item 3.5.1-43, are also listed as fire barriers that are in the scope of the 10 CFR 54.4(a)(2) criterion, and, therefore, the Fire Protection Program was also credited. The Fire Protection Program and Masonry Wall Program perform visual inspections on a periodic basis to manage cracking due to restraint shrinkage, creep, and aggressive environments. On the basis that periodic visual inspections are performed, the staff finds the applicant's use of the Fire Protection Program to be acceptable.

On the basis of its review of AMR result lines as described in the preceding paragraphs and its comparison of the applicant's results to corresponding recommendations in the GALL Report, the staff finds that the applicant addressed the AERMs adequately, as recommended by 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, in accordance with 10 CFR 54.21(a)(3).

3.5.2.1.3 Loss of Material Due to Abrasion and Cavitation

In the discussion section of LRA Table 3.5.1, item 3.5.1-45, the applicant indicated that loss of material due to abrasion and cavitation is managed by the Structures Monitoring Program. During the review, the staff noted that for the AMR results line pointing to Table 3.5.1, item 3.5.1-45, for five groups the applicant included a reference to LRA Note E and one group with LRA Note I.

The staff reviewed the AMR results line items referenced to LRA Note E, and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants," the applicant has proposed using the Structures Monitoring Program (SER Section 3.0.3). The AMR result line items that reference LRA Table 3.5.1, item 3.5.1-45, are concrete foundation and interior slab members in the Water-Control Structure. However, the Water-Control Structure is in the scope for the Structures Monitoring Program and the Structures Monitoring Program performs visual inspections to manage loss of material due to abrasion and cavitation. On the basis that periodic visual inspections are performed, the staff finds the applicant's use of the Structures Monitoring Program to be acceptable.

On the basis of its review of AMR result line items as described in the preceding paragraphs and its comparison of the applicant's results to corresponding recommendations in the GALL Report, the staff finds that the applicant addressed the AERMs adequately, as recommended by 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, in accordance with 10 CFR 54.21(a)(3).

3.5.2.1.4 Loss of Material Due to General (Steel Only), Pitting, and Crevice Corrosion

In the discussion section of LRA Table 3.5.1, item 3.5.1-47, the applicant indicated that loss of material due to general, pitting, and crevice corrosion is managed by the Structures Monitoring Program. During the review, the staff noted that for the AMR results line pointing to Table 3.5.1, item 3.5.1-47, for thirteen groups the applicant included a reference to LRA Note E.

The staff reviewed the AMR results lines referenced to LRA Note E and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, whereas the GALL Report recommends AMP XI.S7, “Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants,” the applicant has proposed using the Structures Monitoring Program (SER Section 3.0.3). The AMR result line items that reference LRA Table 3.5.1, item 3.5.1-47, are structural steel members in the Water-Control Structure. However, the Water-Control Structure is in the scope for the Structures Monitoring Program and the Structures Monitoring Program includes visual inspections to manage loss of material due to general, pitting, and crevice corrosion. On the basis that periodic visual inspections are performed, the staff finds the applicant’s use of the Structures Monitoring Program to be acceptable.

On the basis of its review of AMR result lines as described in the preceding paragraphs and its comparison of the applicant’s results to corresponding recommendations in the GALL Report, the staff finds that the applicant addressed the AERMs adequately, as recommended by 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, in accordance with 10 CFR 54.21(a)(3).

3.5.2.1.5 Loss of Material for Carbon Steel Exposed to Indoor Uncontrolled Air

In LRA Table 3.5.2-4, for three line items which reference Table 1 item 3.5.1-39, the applicant proposed to manage loss of material for carbon steel Cardox hose reel, damper framing, and fire hose reels exposed to an indoor uncontrolled air environment by using the Fire Protection Program or the Fire Water System Program. The AMR line item cites LRA Note E, which indicates that a different AMP is credited in the GALL Report.

The staff reviewed the AMR items referenced with LRA Note E, and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends AMP XI.S6, “Structures Monitoring Program” the applicant has proposed using the Fire Protection Program or the Fire Water System Program (SER Section 3.0.3). The staff is not clear how the above programs satisfy the recommendations of the Structures Monitoring Program. Therefore, RAI 3.5.2.2.2.6-1 dated August 28, 2009, was issued asking the applicant to explain how the above mentioned AMPs meet or exceed the inspection recommendations of the Structures Monitoring Program. The applicant’s response is discussed in SER Section 3.5.2.2.2.6

On the basis of its review of the AMR results and responses to RAIs as described in the preceding paragraphs, and its comparison of the applicant’s results to corresponding recommendations in the GALL Report, the staff finds that the applicant addressed the AERMs adequately, as recommended by 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, in accordance with 10 CFR 54.21(a)(3).

3.5.2.1.6 Loss of Sealing and Leakage Through Containment Due to Deterioration of Joint Seals, and Gaskets

In LRA Table 3.5.2-1, for two line items which reference Table 1 item 3.5.1-16, the applicant proposed to manage cracking and change in material properties for PC electrical penetration seals and moisture barriers exposed to an indoor uncontrolled air environment by using the Structures Monitoring Program. The AMR line items cite LRA Note E, which indicates that a different AMP is credited in the GALL Report.

The staff reviewed the AMR line item and determined that the component type, material, environment, and aging effect are consistent with the corresponding GALL Report line item II.B4-7; however, where the GALL Report recommends AMP XI.S1, “ASME Code Section XI, Subsection IWE,” and AMP XI.S4, “10 CFR 50, Appendix J” the applicant has proposed using the Containment Leak Rate Program (SER Section 3.0.3). The Containment Leak Rate Program performs periodic surveillance and leak rate tests to manage loss of sealing and leakage through containment due to deterioration of electrical penetration seals. On the basis that periodic surveillance and leak rate tests are performed, the staff finds the applicant’s use of the Containment Leak Rate Program to be acceptable.

In LRA Table 3.5.2-4, for two line items which reference Table 1 item 3.5.1-16, the applicant proposed to manage cracking and change in material properties for seals and gaskets exposed to an indoor uncontrolled air environment by using the Structures Monitoring Program. The AMR line item cites item LRA Note E, which indicates that a different AMP is credited in the GALL Report.

The staff reviewed the AMR line item and determined that the component type, material, environment, and aging effect are consistent with the corresponding GALL Report, item II.B4-7; however, where the GALL Report recommends AMP XI.S1, “ASME Code Section XI, Subsection IWE,” and AMP XI.S4, “10 CFR 50, Appendix J” the applicant has proposed using the Structures Monitoring Program (SER Section 3.0.3). The Structures Monitoring Program performs visual inspections to manage loss of sealing and leakage due to deterioration of joint seals and gaskets. On the basis that periodic visual inspections are performed, the staff finds the applicant's use of the Structures Monitoring Program to be acceptable.

On the basis of its review of the AMR results as described in the preceding paragraphs, and its comparison of the applicant’s results to corresponding recommendations in the GALL Report, the staff finds that the applicant appropriately addressed the AERMs, as recommended by 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, in accordance with 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.

3.5.2.2.1 Pressurized Water Reactor and Boiling Water Reactor Containments

<u>3.5.2.2.1.1 Aging of Inaccessible Concrete Areas</u>. In LRA Section 3.5.2.2.1.1, the applicant indicated that CNS has a Mark I free-standing steel containment located within the reactor building. The applicant also stated that inaccessible and accessible concrete areas are designed in accordance with ACI 318-63, Building Code Requirements for Reinforced Concrete. The applicant further stated that CNS concrete also meets requirements of ACI 201.2R-77, Guide to Durable Concrete, since both documents use the same ASTM standards for selection,

application and testing of concrete. The applicant also further stated that the absence of concrete aging effects is confirmed under the Structures Monitoring Program.

The staff reviewed LRA Section 3.5.2.2.1.1 against the criteria in SRP-LR Section 3.5.2.2.1.1, which states that increases in porosity and permeability, cracking, loss of material (spalling scaling) due to aggressive chemical attack, and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel could occur in inaccessible areas of concrete and steel containments. The SRP-LR also states that the existing program relies on ASME Code Section XI, Subsection IWL to manage these aging effects. The SRP-LR further states that the GALL Report recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas if the environment is aggressive. To ensure non-aggressive groundwater chemistries, the GALL Report suggests the periodic monitoring of below-grade water chemistry includes consideration of potential seasonal variations for chlorides, sulfates, and pH. The staff noted that CNS has a Mark I free-standing steel containment located within the reactor building; therefore, ASME Code Section XI, Subsection IWL was not applied, and the applicant's groundwater inspections are performed by the applicant's Structures Monitoring Program described in LRA Section B.1.36. The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3.

The staff was unable to confirm that CNS concrete is designed in accordance with ACI 318-63 and ACI 201.2R-77; therefore, on August 28, 2009, the staff issued RAI 3.5-1 to provide additional information for the staff to review. The applicant responded by letter dated September 24, 2009. The staff reviewed the response and required further information regarding the air content and water-cement ratio of the concrete. Conference calls were held on November 9, 2009, and January 8, 2010 to discuss the issue. As a followup to the conference calls, the applicant provided concrete compression test results which demonstrated that the CNS concrete achieved the appropriate strength with acceptable design values in accordance with the appropriate codes. This issue is discussed in more detail in SER Section 3.5.2.2.1.10. The staff also confirmed that the frequency of monitoring groundwater chemistries under the applicant's Structures Monitoring Program agrees with the recommendation of the GALL Report for groundwater monitoring.

Based on the programs identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.1. For those line items that apply to LRA Section 3.5.2.2.1.1, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.5.2.2.1.2 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. In the LRA Section 3.5.2.2.1.2, the applicant indicated that CNS does not rely on a dewatering system for control of settlement. The reactor building is supported by a reinforced concrete mat foundation constructed on a dense structural fill, extending from the bedrock surface to the mat foundation. The applicant also stated that the secondary containment was not identified in IN 97-11 as susceptible to erosion of porous concrete subfoundation. The applicant further stated that CNS groundwater is not aggressive and no changes in groundwater conditions have been observed. The applicant concluded that, as a result, 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 are not aging effects requiring management.

The staff reviewed LRA Section 3.5.2.2.1.2 against the criteria in SRP-LR Section 3.5.2.2.1.2, which states that cracks and distortion due to increased stress levels from settlement could occur in concrete and steel containments. SRP-LR Section 3.5.2.2.1.2 also states that reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations could occur in all types of containments. SRP-LR Section 3.5.2.2.1.2 further states that the GALL Report recommends no further evaluation if this activity is within the scope of the applicant’s Structures Monitoring Program. The staff was unable to verify the applicant’s claim. Therefore, on August 28, 2009, the staff issued a RAI 3.5-1 to provide additional information for the staff to review. In a letter dated September 24, 2009, the applicant indicated that the containment foundation is not exposed to a soil environment. Consequently, the NUREG-1801 items that reference this SRP-LR section are not applicable to Mark I steel containments. The applicant further stated the Structures Monitoring Program includes inspections of the reactor building structures to confirm the absence of aging effects caused by settlement. A porous concrete subfoundation is not a design feature of the CNS reactor building. The applicant also provided three sampling test wells in November 2006, which yield the following results for CNS below-grade water chemistry:

	Test Hole B-31	Test Hole B-12	Test Hole B-1
pH	7.0	8.0	7.6
Chloride	24.4 ppm	17.0 ppm	22.0 ppm
Sulfate	82.5 ppm	33.0 ppm	74.1 ppm

The staff found the applicant’s response acceptable as it relates to this evaluation, because, CNS ground water is not aggressive and porous concrete subfoundation is not a design feature of the CNS reactor building. The staff’s review of RAI 3.5-1 is discussed further in SER Section 3.5.2.2.1.10.

The staff’s review of the applicant’s response to the RAI 3.5-1, USAR Section 2.2, and the Structures Monitoring Program is documented in SER Section 3.0.3. The staff confirmed that structures subject to this AMR are all in-scope of the Structures Monitoring Program (after reviewing the response to RAI 3.5-1). Therefore, the staff finds that the criteria of SRP-LR Section 3.5.2.2.1.2 have been met, and no further evaluation is required.

3.5.2.2.1.3 Reduction of Strength and Modulus of Concrete Structures due to Elevated Temperature. In LRA Section 3.5.2.2.1.3, the applicant indicated that the NUREG-1801 reference to this issue is associated with concrete containments. The applicant also stated that this aging effect is not applicable since CNS has a Mark I steel containment.

The staff reviewed the LRA Section 3.5.2.2.1.3 and the staff finds that the section is not applicable to CNS because CNS has a Mark I steel containment. Therefore, the staff determines that no further evaluation is required.

3.5.2.2.1.4 Loss of Material due to General, Pitting and Crevice Corrosion. In LRA Section 3.5.2.2.1.4, the applicant indicated that CNS containment is a Mark I steel containment located within the reactor building. The applicant also indicated that the CNS reactor building concrete is designed in accordance with ACI 318-63, Building Code Requirements for Reinforced Concrete and ACI 201.2R-77, "Guide to Durable Concrete" since both documents use the same ASTM standards for selection, application and testing of concrete. The applicant further stated that concrete is monitored for cracks under the Structures Monitoring Program. The applicant also further stated that the sand cushion area is drained to protect the exterior surface of the drywell shell. In addition, the applicant indicated that the Containment ISI Program and Containment Leak Rate Program will manage this aging effect. The applicant further stated that to prevent corrosion of the lower part of the drywell, the interior and exterior surfaces are protected from contact with the atmosphere by complete concrete encasement. The applicant also stated that the drywell steel where the drywell shell becomes embedded in the concrete floor is inspected in accordance with the Containment ISI Program and Structures Monitoring Program. Therefore, the applicant concluded that significant corrosion of the drywell shell is not expected.

The staff reviewed LRA Section 3.5.2.2.1.4 against the criteria in SRP-LR Section 3.5.2.2.1.4, which states that loss of material due to general, pitting and crevice corrosion, could occur in steel elements of accessible and inaccessible areas for all types of PWR and BWR containments. SRP-LR Section 3.5.2.2.1.4 further states that the existing program relies on ASME Code Section XI, Subsection IWE, and 10 CFR Part 50, Appendix J, to manage loss of material due to general, pitting and crevice corrosion. The GALL Report recommends further evaluation of plant-specific programs to manage this aging effect for inaccessible areas if corrosion is significant. GALL Report item II.B1.1-2 states that for inaccessible areas (embedded steel shell or liner) loss of material due to corrosion is not significant if the following four conditions are satisfied:

(1) Concrete meeting the specifications of American Concrete Institute (ACI) 318 or 349 and the guidance of ACI 201.2R was used for the containment concrete in contact with the embedded containment shell or liner.

(2) The concrete is monitored to ensure that it is free of penetrating cracks that provide a path for water seepage to the surface of the containment shell or liner.

(3) The moisture barrier, at the junction where the shell or liner becomes embedded, is subject to aging management activities in accordance with ASME Code Section XI, Subsection IWE requirements.

(4) Water ponding on the containment concrete floor is not common and when detected is cleaned up in a timely manner.

On the basis of its audit and review, the staff determined that corrosion is not significant for inaccessible areas of the CNS containment. In the LRA, the applicant indicated that the reactor building concrete in contact with the drywell shell is designed in accordance with ACI 318-63, and meets the recommendations of guideline ACI 201.2R-77. The staff verified this during the review, and the issue is discussed further in SER Section 3.5.2.2.2.1 and the responses to RAIs 3.5-1 and 3.5.2.2.2.2-1 dated September 24, 2009. The applicant also stated that accessible concrete of the reactor building is monitored for penetrating cracks in accordance with the CNS

Structures Monitoring Program. This addresses the second point in the GALL Report since it is the concrete in contact with the embedded containment. The staff also verified that the junction where the containment becomes embedded is inspected under the Containment ISI and Structures Monitoring programs and that water ponding is not common. Since the four GALL Report conditions are met, the staff finds that no additional plant-specific AMP is required to manage inaccessible areas of the containment drywell shell and associated components.

In addition, the staff issued RAI B.1.10-1 requesting the applicant further explain why corrosion in the sand bed region of the drywell was not significant. In its response dated June 15, 2009, the applicant committed to perform vacuum tests of all sand bed drain lines prior to the period of extended operation to demonstrate that no moisture was present in the sand bed region (Commitment No. 5). The staff also issued RAIs (B.1.10-6 and B.1.10-7) requesting more information about degradation in the torus and any plans to recoat the torus. Both of these items are discussed in more detail in the Containment ISI Program discussion (SER Section 3.0.3) and the torus degradation related AMP issue is to be resolved under open item OI 3.0.3.2-1.

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 determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.5.2.2.1.5 Loss of Prestress Due to Relaxation, Shrinkage, Creep, and Elevated Temperature. In LRA Section 3.5.2.2.1.5, the applicant indicated that CNS is a Mark I steel containment and does not incorporate prestressed concrete in its design. The applicant also indicated that loss of prestress due to relaxation, shrinkage, creep, and elevated temperature do not apply.

The staff reviewed the LRA Section 3.5.2.2.1.5 and finds that this aging effect is not applicable because CNS has a Mark I steel containment. Therefore, the staff determines that no further evaluation is required.

3.5.2.2.1.6 Cumulative Fatigue Damage. LRA Section 3.5.2.2.1.6 indicates that TLAAs are evaluated in accordance with 10 CFR 52.21(c) as documented in Section 4. Fatigue TLAAs for the torus, torus to drywell vent system, and torus penetrations are evaluated as documented in Section 4.6 of the LRA.

SRP-LR Section 3.5.3.2.1.6 states that if included in the CLB, fatigue analyses of suppression pool steel shells and penetrations for all types of PWR and BWR containments and BWR vent header, vent line bellows, and downcomers are TLAAs as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c).

The staff's review of the applicant's TLAA for the torus, torus to drywell vent system, and torus penetrations is documented in SER Section 4.6.

3.5.2.2.1.7 Cracking due to Stress-Corrosion Cracking. LRA Section 3.5.2.2.1.7 indicates that SSC requires simultaneous action of a corrosive environment, sustained tensile stress, and a susceptible material. The LRA further indicates that the susceptible components at CNS are located in a non-corrosive environment and the temperature does not exceed limits; therefore, the components do not require additional inspections and the aging effects can be adequately managed under the ASME Code Section XI, Subsection IWE and 10 CFR 50 Appendix J programs.

The staff reviewed LRA Section 3.5.2.2.1.7 against the criteria in SRP-LR Section 3.5.2.2.1.7 which states that SSC of stainless steel penetration sleeves and dissimilar metal welds can occur in all types of PWR and BWR containments. The Containment ISI Program and leak rate testing may not be sufficient to detect cracks, especially for dissimilar metal welds. Additional examinations or evaluations are recommended to address this issue.

In LRA Table 3.5.1, items 10 and 11, the applicant discusses augmented exams to detect cracking in these components. The staff is not clear what the augmented exams consist of, or how the exams will be used to detect fine cracks. Therefore, RAI 3.5.2.2-1 dated August 28, 2009, was issued, asking the applicant to provide this information.

By letter dated September 24, 2009, the applicant indicated that the Containment ISI Program contains provisions for performing augmented examinations of components likely to experience accelerated degradation and aging. The applicant further explained that the augmented examinations are not applied to stainless steel components and dissimilar metal welds identified in LRA Table 3.5.1, items 10 and 11 since those components have not been judged likely to experience accelerated degradation and aging. The applicant also stated that CNS will continue to perform a periodic integrated leak rate test of the overall PC, which is capable of detecting leakage in the event of through-wall cracking, and will perform local leakage rate tests of expansion bellows.

The staff reviewed the applicant’s response and required additional information to complete its review. Information Notice 92-20 discusses issues with containment bellows which may invalidate the results of local leakage rate tests. The applicant’s response did not address how the local leakage tests would be accomplished, or the type of bellows present at CNS. During a conference call on November 9, 2009, the applicant explained that the MS and FW penetrations consist of double-layered or “2-ply” bellows which are locally leak tested by pressurizing the annulus between the layers. The bellows are also tested during the containment integrated leak rate tests. More information on this issue is contained in SER Section 3.0.3, the Containment Leak Rate Program review write-up.

The staff reviewed the information provided in the original RAI response as well as the information provided during the conference call and found that the leak rate tests being performed on the penetrations are capable of detecting cracking. Therefore, the staff determines that no additional further evaluation is required.

<u>3.5.2.2.1.8 Cracking Due to Cyclic Loading</u>. LRA Section 3.5.2.2.1.8 indicates that cracking due to cyclic loading is not expected at CNS and that the existing Containment Leak Rate Program with augmented exams and the Containment ISI Program will continue to be used to detect cracking. The applicant also stated that observed potential issues will be evaluated or corrected in accordance with the Corrective Action Program.

The staff reviewed LRA Section 3.5.2.2.1.8 against the criteria in SRP-LR Section 3.5.2.2.1.8 which states that cracking due to cyclic loading of suppression pool steel and stainless steel shells and penetrations could occur for 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.

In LRA Section 3.5.2.2.1.8 and LRA Table 3.5.1, items 12 and 13, the applicant discussed augmented exams. The staff is not clear what the augmented exams consist of, or how the exams will be used to detect fine cracks. Therefore, in RAI 3.5.2.2-2 dated August 28, 2009, the staff requested the applicant to provide this information.

By letter dated September 24, 2009, the applicant indicated that the items in question were not applicable for CNS components. The applicant explained that the corresponding items in the GALL Report (II.B4-3 and II.B1.1-3) are applicable if a CLB fatigue analysis does not exist. The applicant further explained that CNS does have fatigue analyses for the subject components; therefore, the calculations are reviewed as TLAA's in Section 4.6. The staff reviewed the applicant's response and verified that the components were included in the TLAA discussion in Section 4.6. Since a CLB fatigue analysis does exist, and the components are being reviewed under Section 4.6, the staff agrees that further evaluation is not necessary in this section.

<u>3.5.2.2.1.9 Loss of Material (Scaling, Cracking, and Spalling) Due to Freeze-Thaw</u>. In LRA Section 3.5.2.2.1.9, the applicant indicated that CNS has a Mark I free standing steel containment located within the reactor buildings. The applicant also stated that loss of material (scaling, cracking, and spalling) due to freeze-thaw is applicable only to concrete containments exposed to an outdoor environment. Therefore, loss of material and cracking due to freeze-thaw is not applicable.

The staff reviewed LRA Section 3.5.2.2.1.9 and the staff agreed with the applicant that loss of material due to freeze-thaw is not applicable to CNS since CNS has a Mark I free standing steel containment located within the reactor building. Therefore, the staff determines that no further evaluation is required.

<u>3.5.2.2.1.10 Cracking Due to Expansion and Reaction with Aggregate, and Increase in Porosity and Permeability Due to Leaching of Calcium Hydroxide</u>. In LRA Section 3.5.2.2.1.10, the applicant indicated that CNS has a Mark I free standing steel containment located within the reactor buildings. The applicant also stated that in accordance with NUREG-1801, aging management is not required because the CNS containment concrete (basemat) is designed in accordance with specification ACI 318-63, "Building Code Requirements for Reinforced Concrete." The applicant further stated that the concrete specification requires potential reactivity of aggregates be acceptable based on testing in accordance with ASTM C-227 and C-295.

The staff reviewed LRA Section 3.5.2.2.1.10 against the criteria in SRP-LR Section 3.5.2.2.1.10, which states that cracking due to expansion and reaction with aggregate, and increase in porosity and permeability due to leaching of calcium hydroxide could occur in concrete elements of concrete and steel containments. SRP-LR Section 3.5.2.2.1.10 also states that the existing program relies on ASME Code Section XI, Subsection IWL to manage these aging effects. SRP-LR Section 3.5.2.2.1.10 further states that the GALL Report recommends further evaluation if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77, "Guide to Durable Concrete."

The staff reviewed the LRA and was unable to verify the applicant's claim that the basemat is designed in accordance with ACI-318-63. Therefore, on August 28, 2009, the staff issued RAI 3.5-1 requesting that the applicant provide additional information for the staff to review. In a letter dated September 24, 2009, the applicant indicated that the CNS concrete specification provided for air content between four and six percent. Concrete strength was established based on Method 2 of ACI 318-63. Method 2 provided for tests of trial mixes to ensure required concrete strength at water-cement ratios that provided sufficient workability. The applicant also stated that the maximum permissible water-cement ratio for the concrete used at CNS was that established by the water-cement ratio versus concrete strength curve produced by Method 2 that yielded an average strength which satisfied the requirements of ACI 318-63 Section 504 ”Strength Test of Concrete.” The maximum permissible water-cement ratio was 0.71 for concrete with 3,000 psi strength and 0.52 for concrete with 4,000 psi strength. The staff reviewed the applicant responses and the recommendations in ACI 201.2R-77. With water-cement ratios of 0.71 or 0.52 and air-entrainment between four to sixpercent, it would be difficult to achieve 3,000 or 4,000 psi concrete. Therefore, the staff participated in conference calls with the applicant on November 9, 2009, and January 8, 2010, to discus the issue. As a followup to the conference calls, the applicant provided concrete compression test results taken during construction, which demonstrated that the CNS concrete achieved the appropriate strength. The staff reviewed the provided test data and verified that the appropriate concrete strength was achieved. The staff also found that the actual water-cement ratios used were always below 0.71. While reviewing the data, the staff noted that a few of the air content values fell outside the GALL Report recommended range of 3 to 6 percent, with the lowest value being 2.2 percent. Although a few of the air content values fall outside of the GALL Report recommendations, the staff finds the applicant’s evaluation acceptable, because the applicant followed Method 2 of ACI 318-63 and used a concrete mix design which provided concrete of the appropriate strength. In addition, the applicant has programs in place to inspect accessible concrete for indications of degradation. Any discovered degradation would be analyzed to see how it impacts inaccessible areas. Therefore, the staff finds the applicant’s approach acceptable and the staff’s concern in RAI 3.5-1 is resolved.

Based on the discussion above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.10. For those line items that apply to LRA Section 3.5.2.2.1.10, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.2 Safety-Related and Other Structures and Component Supports

<u>3.5.2.2.2.1 Aging of Structures Not Covered by Structures Monitoring Program</u>. In LRA Section 3.5.2.2.2.1, the applicant indicated that the CNS concrete structures subject to an AMR are included in the Structures Monitoring Program and are supplemented by other AMPs as appropriate. The applicant also stated that this is true for concrete structures even if the AMR did not identify aging effects requiring management. The applicant further indicated that aging effects for structural steel items discussed in this section are also addressed in the 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, which states that the GALL Report recommends further evaluation of certain structure/aging effect combinations if they are not covered by the Structures Monitoring Program. The GALL Report recommends further evaluation only for structure/aging effect combinations that are not within the Structures Monitoring Program. In addition, SRP-LR Section 3.5.2.2.2.1 also states that lock up due to wear could occur for Lubrite® radial beam seats in BWR drywell, RPV support shoes for PWR with nozzle supports, steam generator supports, and other sliding support bearings and sliding support surfaces. The existing program relies on the Structures Monitoring Program or ASME Code Section XI, Subsection IWF to manage this aging effect. The GALL Report recommends further evaluation only for structure/aging effect combinations that are not within the ISI – IWF Program or Structures Monitoring Program. During its review, the staff noted that in LRA Subsection 3.5.2.2.2.1, item 1 through 3.5.2.2.2.1, item 8, the applicant indicated (for each subsection) that there are no aging effects requiring management. However, the criteria in SRP-LR Section 3.5.2.2.2.1, indicates that the GALL Report recommends further evaluation only for structure/aging effect combinations that are not within the Structures Monitoring Program. It is not clear to the staff how the applicant is going to meet the GALL Report recommendation to manage aging effects; therefore by letter dated August 28, 2009, the staff issued RAI 3.5-1 requesting that the applicant clarify how it plans to meet the GALL Report recommendation.

In its response dated September 24, 2009, the applicant stated that the Structures Monitoring Program provides for inspections of accessible areas. If findings on accessible structures or components indicate that potential degradation may be occurring in inaccessible areas, an evaluation will be performed and appropriate corrective actions will be taken under the Corrective Action Program. The applicant also stated that this involves no additional commitments since the corrective action and confirmation processes are elements of the existing Structures Monitoring Program. The staff's review of the applicant's responses and the Structures Monitoring Program are documented in SER Section 3.5.2.2.1, item 10 and SER Section 3.0.3. Additional reviews of specific aging effects/mechanisms are discussed below.

(1) Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling) Due to Corrosion of Embedded Steel for Groups 1-5, 7, and 9 Structures

In LRA Section 3.5.2.2.2.1, item 1, the applicant indicated that the below-grade environment for CNS is not aggressive and concrete is designed in accordance with specification ACI 318-63, "Building Code Requirements for Reinforced Concrete." The applicant also stated that cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel are not aging effects requiring management for CNS Groups 1-5, 7, and 9 structures (RAI 3.5-1 response).

The staff's reviews for cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel for inaccessible concrete areas of containments, below-grade inaccessible concrete areas of Groups 1-5, 7, and 9 structures, the applicant responses to RAI 3.5-1, and the Structures Monitoring Program are documented in SER Section 3.0.3. The staff confirmed that Groups 1-5, 7, and 9 structures subject to this AMR are all in-scope of the Structures Monitoring Program. Therefore, the staff finds that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

(2) Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling) Due to Aggressive Chemical Attack for Groups 1-5, 7, and 9 Structures

In LRA Section 3.5.2.2.2.1, item 2, the applicant indicated that these groups of structures at CNS used a dense low permeable concrete, adequate concrete cover, and specific water-to-cement ratio, which provides an acceptable degree of protection against aggressive chemical attack. The applicant also stated that the water chemical analysis results confirm that the site groundwater is considered to be non-aggressive. The applicant further stated that increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack are not aging effects requiring management for Groups 1-5, 7, and 9 structures.

The staff's review for 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 applicant responses to RAI 3.5-1, and the Structures Monitoring Program are documented in SER Section 3.0.3. The staff confirmed that Groups 1-5, 7, and 9 structures subject to this AMR are all in-scope of the Structures Monitoring Program.

Therefore, the staff finds that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

(3) Loss of Material Due to Corrosion for Groups 1-5, 7, and 8 Structures

In LRA Section 3.5.2.2.2.1, item 3, the applicant indicated that the Structures Monitoring Program manages loss of material for most steel structural components for CNS Groups 1-5, 7, and 8 structures. The applicant also stated that in some cases the PSPM Program and Fire Protection Program supplement the Structures Monitoring Program. The applicant further stated that the Fire Protection Program uses periodic visual inspections to manage loss of material for some roof decking.

The staff's reviews for loss of material due to corrosion for Groups 1-5, 7, and 8 structures, the Structures Monitoring Program, the PSPM Program, and the Fire Protection Program are documented in SER Section 3.0.3. The staff confirmed that Groups 1-5, 7, and 8 subject to this AMR are all in-scope of the Structures Monitoring Program, PSPM Program, and/or the Fire Protection Program. Therefore, the staff finds that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

(4) Loss of Material (Spalling, Scaling) and Cracking Due to Freeze-Thaw for Groups 1-3, 5, and 7-9 Structures

In LRA Section 3.5.2.2.2.1, item 4, the applicant indicated that CNS is located in a moderate to severe weathering location. The applicant also indicated that aggregates were in accordance with specifications and materials conforming to ACI and ASTM standards. The applicant further indicated that CNS structures were constructed within the limits provided in ACI 318-63, and air entrainment percentages were within the range prescribed in the GALL Report recommendation. Therefore, the applicant concluded that loss of material (spalling, scaling) and cracking due to freeze-thaw are not aging effects requiring management for Groups 1-3, 5, and 7- 9 structures.

The staff's reviews for loss of material (spalling, scaling) and cracking due to freeze-thaw for Groups 1-3, 5, and 7-9 structures, the applicant's responses to RAI 3.5-1, and the Structures Monitoring Program are documented in SER Section 3.0.3. Further evaluation of the AMR is documented in SER Section 3.5.2.2.1.10. The staff confirmed that Groups 1-3, 5, and 7-9 structures subject to this AMR are all in-scope of the Structures Monitoring Program. Therefore, the staff finds that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

(5) Cracking Due to Expansion and Reaction with Aggregates for Groups 1-5 and 7-9 Structures

In LRA Section 3.5.2.2.2.1, item 5, the applicant indicated that aggregates were selected locally and were in accordance with specification and materials conforming to ACI and ASTM standards at the time of constructions. The applicant also stated that CNS met the recommendations in ACI 201.2R-77, "Guide to Durable Concrete," for concrete durability. The applicant further indicated that CNS structures were constructed within the limits provided in ACI 318-63, and air entrainment percentages were within the range prescribed in the GALL Report recommendation. Therefore, the applicant concluded that cracking due to expansion and reaction with aggregates for Groups 1-5 and 7-9 structures is not an aging effect requiring management.

The staff's reviews for cracking, due to expansion and reaction with aggregates for Groups 1-5 and 7-9 structures, the applicant's responses to RAI 3.5-1, and the Structures Monitoring Program are documented in SER Section 3.0.3. The staff confirmed that Groups 1-5 and 7-9 structures subject to this AMR are all in-scope of the Structures Monitoring Program. Therefore, the staff finds that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

(6) Cracks and Distortion Due to Increased Stress Levels from Settlement for Groups 1-3 and 5-9 Structures

In LRA Section 3.5.2.2.2.1, item 6, the applicant indicated that CNS does not rely on a dewatering system for control of settlement. The applicant also stated that settlement is not a credible event since structures are founded on bedrock. Therefore, the applicant concluded that cracks and distortion due to increased stress levels from settlement for Groups 1-3 and 5-9 structures is not an aging effect requiring management.

The staff's reviews for cracks, and distortion due to increased stress levels from settlement for Groups 1-3 and 5-9 structures, CNS USAR Section 2.2, station foundation support, and the Structures Monitoring Program are documented in SER Section 3.0.3. The staff confirmed that Groups 1-3 and 5-9 structures are founded on bedrock and subject to this AMR are all in-scope of the Structures Monitoring Program. Therefore, the staff finds that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

(7) Reduction in Foundation Strength, Cracking, and Differential Settlement Due to Erosion of Porous Concrete Subfoundation for Groups 1-3 and 5-9 Structures

In LRA Section 3.5.2.2.2.1, item 7, the applicant indicated that CNS does not rely on a dewatering system for control of settlement. The applicant also indicated that structures are supported on dense, consolidated fill and erosion of the subfoundation is not credible since the subfoundation is also eliminating the possibility of loss of soil that results in voids below the subgrade. The applicant further indicated that fluid leakage across the subfoundation is captured by drains provided in the base slab and inspected for any material loss. The applicant also indicated that operating history has not identified any losses to date and therefore, reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundation are not aging effects requiring management for Groups 1-3 and 5-9 structures.

The staff's reviews for reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundation for Groups 1-3 and 5-9 structures, CNS USAR Section 2.2, station foundation support, and the Structures Monitoring Program are documented in SER Section 3.0.3. The staff confirmed that Groups 1-3 and 5-9 structures do not rely on a dewatering system for control of settlement, and subject to this AMR are all in-scope of the Structures Monitoring Program. Therefore, the staff agrees that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required.

(8) Lockup Due to Wear for Lubrite® Radial Beam Seats in BWR Drywell and Other Sliding Support Surfaces

In LRA Section 3.5.2.2.2.1, item 8, the applicant indicated that it does not utilize Lubrite® plates in the drywell beam seats. However, the applicant further indicated that sliding support surfaces associated with the torus ring girder are included within the Structures Monitoring Program and ISI – IWF Program.

The staff reviewed LRA Section 3.5.2.2.2.1, item 8 against the criteria in SRP-LR Section 3.5.2.2.2.1, item 8 which states that lock up due to wear could occur for Lubrite® radial beam seats in BWR drywells, RPV support shoes for PWRs with nozzle supports, steam generator supports, and other sliding support bearings and sliding support surfaces. The GALL Report recommends further evaluation only for structure/aging effect combinations that are not within the ISI – IWF Program or Structures Monitoring Program.

This AERM is not applicable because Lubrite® is not used in the beam seats at CNS. In addition, the applicant inspects torus ring girder sliding supports under the Structures Monitoring and ISI – IWF Programs. The staff agrees that the criteria of SRP-LR Section 3.5.2.2.2.1 have been met, and no further evaluation is required. The staff's review of the Structures Monitoring Program and the ISI – IWF Program are documented in SER Section 3.0.3.

Based on the programs identified and the applicant's response to RAI 3.5-1, the staff concludes that the applicant's programs meet 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, in accordance with 10 CFR 54.21(a)(3).

3.5.2.2.2.2 Aging Management of Inaccessible Areas. In LRA Section 3.5.2.2.2.2, the applicant indicated that CNS concrete Group 1-3, 5, and 7-9 inaccessible concrete areas were designed in accordance with ACI 318-63, "Building Code Requirements for Reinforced Concrete." The applicant also stated that CNS concrete meets requirements of ACI 201.2R-77, "Guide to Durable Concrete." The applicant further stated that "Inspection of accessible concrete have not revealed degradation related to corrosion of embedded steel. CNS below-grade environment is not aggressive. Therefore, corrosion of embedded steel is not an aging effect requiring management for CNS concrete."

The staff reviewed LRA Section 3.5.2.2.2.2 against the criteria in SRP-LR Section 3.5.2.2.2.2 and found that under the SRP-LR Section 3.5.2.2.2.2, there are five separate areas that need to be addressed. These areas are: (1) loss of material and cracking due to freeze-thaw; (2) cracking due to expansion and reaction with aggregates; (3) cracks and distortion due to increased stress levels from settlement; (4) increase in porosity and permeability, cracking, loss of material due to aggressive chemical attack; and (5) increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide.

The staff was unable to review the applicant's LRA for the above five items, as they were missing from the LRA; therefore, on August 28, 2009, the staff issued RAI 3.5.2.2.2.2-1 to ask the applicant to provide the missing items for the staff to review.

In a letter dated September 24, 2009, the applicant indicated that the related information in SRP-LR Section 3.5.2.2.2.2 is addressed in LRA Section 3.5.2.2.2. Specifically, SRP-LR 3.5.2.2.2.2, item 1 is addressed by LRA Section 3.5.2.2.2.1, item 4; SRP-LR 3.5.2.2.2.2, item 2 by LRA Section 3.5.2.2.2.1, item 5; SRP-LR 3.5.2.2.2.2, item 3 by LRA Section 3.5.2.2.2.1, item 6 and item 7; and SRP-LR 3.5.2.2.2.2, item 4 by LRA Section 3.5.2.2.2.1, item 2. The related information applicable to SRP-LR Section 3.5.2.2.2.2, item 5 is provided in LRA Subsection 3.5.2.2.2.4, item 3. The applicant also stated that while LRA Section 3.5.2.2.2.4, item 3 is under the category of Group 6 structures, the discussion also applies to concrete in Groups 1-3, 5, and

7-9. The staff reviewed the applicant's response and found it acceptable, because the safety-related concrete structures at CNS are designed in accordance with the ACI 318-63 and ACI 201.2R-77 (Ref: RAI 3.5-1). Therefore, the staff finds that the missing five items have been addressed in LRA, and no further evaluation is required.

3.5.2.2.2.3 Reduction of Strength and Modulus of Concrete Structures due to Elevated Temperature. The applicant indicated in LRA Section 3.5.2.2.2.3 that CNS Group 1-5 concrete structures are maintained below the 150 °F threshold for general areas and under 200 °F for local areas.

The staff reviewed LRA Section 3.5.2.2.2.3 against the criteria in SRP-LR Section 3.5.2.2.2.3, which states that reduction of strength and modulus of concrete due to elevated temperatures could occur in PWR and BWR Group 1-5 concrete structures. For any concrete elements that exceed specified temperature limits, further evaluations are recommended. SRP-LR Section 3.5.2.2.2.3 also states the GALL Report recommends further evaluation of a plant-specific program if any portion of the safety-related and other concrete structures exceeds specified temperature limits(i.e., general area temperature greater than 150 °F(66 °C) and local area temperature greater than 200 °F(93 °C)).

The staff reviewed the LRA, USAR Table V-2-3 and found that no portion of the in-scope concrete structures and concrete at CNS exceeds specified temperature limits, which are 150 °F for general areas and 200 °F for local areas. Therefore, this aging effect is not applicable to CNS.

On the basis of its review, the staff finds that reduction of strength and modulus of concrete due to elevated temperatures are not applicable aging effects to CNS because the conditions necessary for the aging effects, elevated temperatures, do not exist. Therefore, the staff finds that no further evaluation is required

3.5.2.2.2.4 Aging Management of Inaccessible Areas for Group 6 Structures. The staff reviewed LRA Section 3.5.2.2.2.4 against the criteria in SRP-LR Section 3.5.2.2.2.4, which states that the GALL Report recommends further evaluation for inaccessible areas of certain Group 6 structure/aging effect combinations as identified below, whether or not they are covered by inspections in accordance with the GALL Report, Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the Federal Energy Regulatory Commission (FERC)/U.S. Army Corp of Engineers (USACE) dam inspections and maintenance.

During the review, the staff noted that the applicant's GALL Report, Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" is in the scope of Structures Monitoring Program. The staff's review of the Structures Monitoring Program and evaluation of aging management of inaccessible areas for Group 6 structures are addressed as follows:

For LRA Section 3.5.2.2.2.4, item 1 (Below-Grade Inaccessible Concrete Areas), the applicant indicated that the below-grade exterior reinforced concrete at CNS is not exposed to an aggressive environment. The applicant also stated 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 are not aging effects requiring management for below-grade inaccessible concrete areas of CNS Group 6 structures.

The staff reviewed LRA Section 3.5.2.2.2.4, item 1, including the AMR and associated AMPs, against the criteria in SRP-LR Section 3.5.2.2.2.4, item 1, which states that increase in porosity and permeability, cracking, loss of material (spalling, scaling)/aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling)/corrosion of embedded steel could occur in below-grade inaccessible concrete areas of Group 6 structures (Ref: RAI 3.5-1).

The staff's review of the applicant's Structures Monitoring Program (B.1.36) found that it is an existing program that will be consistent with GALL AMP XI.S6, "Structures Monitoring Program" when the program enhancements are implemented. This is documented in SER Section 3.0.3. Moreover, the staff found that concrete strength was established based on Method 2 of ACI 318-63, "Building Code Requirements for Reinforced Concrete." Method 2 required tests of trial mixes to ensure required concrete strength at water-cement ratios and sufficient air entrainment that provided sufficient workability. The maximum permissible water-cement ratio for the concrete used at CNS was that established by the water-cement ratio versus concrete strength curve produced by Method 2 that yielded an average strength which satisfied the requirements of ACI 318-63 Section 504, "Strength Test of Concrete." By providing the concrete that would resist damage due to freeze-thaw, adequate air entrainment (four and six percent) was provided. The issue of water-cement ratio and air entrainment, as well as RAI 3.5-1, is discussed in detail in SER Section 3.5.2.2.1.10. The frequency of groundwater chemistry sampling under the applicant's Structures Monitoring Program is consistent with the recommendation of the GALL Report for groundwater monitoring. Therefore, the staff finds the applicant's approach in addressing this item acceptable.

On the basis of its review, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.4, item 1. For those line items that apply to LRA Section 3.5.2.2.2.4, item 1, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

<u>For LRA Section 3.5.2.2.2.4, item 2</u> (Loss of Material of Spalling and Scaling Types and Cracking Due to Freeze-Thaw Could Occur in Below-Grade Inaccessible Concrete Areas for Group 6 Structures), the applicant indicated that the aggregates were selected locally and were in accordance with specifications and material conforming to ACI and ASTM standards at the time of construction. The applicant also indicated that water-cement ratios were within the limits provided in ACI 318, and air entrainment percentages were within the range prescribed in NUREG-1801. The applicant further indicated that loss of material (spalling, scaling) and cracking due to freeze thaw are not aging effects requiring management for CNS Group 6 structures (Ref: RAI 3.5-1).

The staff reviewed LRA Section 3.5.2.2.2.4, item 2, against the criteria in SRP-LR Section 3.5.2.2.2.4, item 2, which states that loss of material (spalling, scaling) and cracking due to freeze-thaw could occur in below-grade inaccessible concrete areas of Group 6 structures. The GALL Report recommends further evaluation of this aging effect for inaccessible areas for plants located in moderate to severe weathering conditions.

The staff noted that the CNS RG 1.127, "Water-Control Structures Inspection" is included in the applicant's Structures Monitoring Program (B.1.36), and is an existing program that is consistent, with enhancements, with GALL AMP XI.S6, "Structures Monitoring Program." The staff's review of the applicant's Structures Monitoring Program is documented in SER Section 3.0.3. The staff also noted that the applicant's Structures Monitoring Program, which requires periodic visual inspection, will be used to manage loss of material (spalling, scaling) and cracking due to freeze-thaw in accessible areas of water-control structures (Group 6 structures). The staff also noted that the Structures Monitoring Program will include examination of exposed concrete for age-related degradation when a below-grade concrete component becomes accessible during excavation. In NUREG-1611, the staff notes that any freeze-thaw degradation would initially appear in the exposed concrete structure.

The staff's review of the applicant's Structures Monitoring Program found that it is an existing program that would be consistent with GALL AMP XI.S6, "Structures Monitoring Program" when the program enhancements are implemented. This is documented in SER Section 3.0.3. Moreover, the staff found that the concrete strength was established based on Method 2 of ACI 318-63. Method 2 required tests of trial mixes to ensure the required concrete strength at the selected water-cement ratios and sufficient air entrainment that provided sufficient workability. The maximum permissible water-cement ratio for the concrete used at CNS was that established by the water-cement ratio versus concrete strength curve produced by Method 2 that yielded an average strength which satisfied the requirements of ACI 318-63 Section 504, "Strength Test of Concrete." By providing concrete that would resist damage due to freeze-thaw, adequate air entrainment (four and six percent) was provided. The issue of water-cement ratio and air entrainment, as well as RAI 3.5-1, is discussed in detail in SER Section 3.5.2.2.1.10. The frequency of groundwater chemistry sampling under the applicant's Structures Monitoring Program is consistent with the recommendation of the GALL Report for groundwater monitoring (SER Section 3.0.3).

Based on the program identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.4, item 2. For those line items that apply to LRA Section 3.5.2.2.2.4, item 2 the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

<u>For LRA Section 3.5.2.2.2.4, item 3</u> (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), the applicant indicated that aggregates used in CNS concrete structures were selected locally and were in accordance with specifications and materials conforming to ACI and ASTM standards at the time of construction, which are in accordance with the recommendations in ACI 201.2R-77, "Guide to Durable Concrete," for concrete durability. The applicant also indicated that CNS structures are constructed of a dense, durable mixture of sound coarse aggregate, fine aggregate, cement, water, and admixture. The applicant further indicated that cracking due to expansion and reaction with aggregate and reaction with aggregates and increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide are not aging effects requiring management in below-grade inaccessible reinforced concrete areas of Group 6 structures (RAI 3.5-1 response).

The staff reviewed LRA Section 3.5.2.2.2.4, item 3 against the criteria in SRP-LR Section 3.5.2.2.2.4, item 3, which states that cracking due to expansion and reaction with aggregates and increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide could occur in below-grade inaccessible reinforced concrete areas of Group 6 structures. The GALL Report recommends further evaluation of inaccessible areas if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77, "Guide to Durable Concrete."

The staff reviewed the LRA including the AMR and the associated AMP, “Structures Monitoring Program.” In NUREG-1611, the staff notes that reaction with aggregates in inaccessible areas would also occur in accessible areas because the same aggregates were used in construction of both accessible and inaccessible areas. The existing Structures Monitoring Program requires periodic examination of accessible concrete surfaces and inspection of inaccessible concrete areas for cracking if excavated for any reason.

On the basis of its review, the staff finds that cracking due to expansion and reaction with aggregate is not a significant aging effect in below-grade inaccessible reinforced concrete areas of Group 6 structures because the absence of the significant aging effects is confirmed from the OE under the existing Structures Monitoring Program. The staff also finds the applicant’s evaluation acceptable because (1) the CNS aggregates were selected locally and were in accordance with ACI and ASTM specifications, and (2) the Structures Monitoring Program includes periodic examination of accessible concrete surfaces, and (3) examination of the exposed concrete areas is conducted when a below-grade concrete component becomes accessible through excavation.

Based on the program identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.4, item 3. For those line items that apply to LRA Section 3.5.2.2.2.4, item 3, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

<u>3.5.2.2.2.5 Cracking Due to Stress-Corrosion Cracking and Loss of Material Due to Pitting and Crevice Corrosion</u>. In LRA Section 3.5.2.2.2.5, the applicant indicated that it does not have Group 7 and 8 stainless steel tank liners. The applicant also stated that the corresponding NUREG-1801 items can be compared to the stainless steel liners of the reactor cavity and drywell sump. These liners can be exposed to a fluid environment and may be subject to loss of material. The applicant further indicated that the Structures Monitoring Program manages loss of material by periodic inspections.

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 could occur for Group 7 and 8 stainless steel tank liners exposed to standing water. The GALL Report recommends further evaluation of plant-specific programs to manage these aging effects.

The staff’s review of the LRA indicated that CNS does not have Group 7 and 8 stainless steel tank liners; therefore, this AMR is not applicable to CNS. However, the applicant used the Structures Monitoring Program to manage cracking due to SCC and loss of material due to pitting of stainless steel liners of the reactor cavity and drywell sump which are similar to the referenced GALL Report Table 5, item 38 or SRP-LR Table 3.5-1, ID 38.

On the basis of its review, the staff finds that cracking due to SCC and loss of material due to pitting and crevice corrosion that could occur for Group 7 and 8 stainless steel tank liners exposed to standing water is not applicable since there are no Group 7 and 8 stainless steel tank liners at CNS.

Based on the program identified above, the staff concludes that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.5. For those line items that apply to LRA Section 3.5.2.2.2.5, the staff determined that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.5.2.2.2.6 Aging of Supports Not Covered by Structures Monitoring Program. LRA Section 3.5.2.2.2.6 states that component supports at CNS are included in the Structures Monitoring Program for Groups B1 through B5.

The staff reviewed LRA Section 3.5.2.2.2.6 against the criteria in SRP-LR Section 3.5.2.2.2.6, which recommends further evaluation of the following support/aging effect combinations if they are not covered by the Structures Monitoring Program.

(1) Loss of Material due to General and Pitting Corrosion for Groups B2 through B5 Supports

LRA Section 3.5.2.2.2.6. item 1 indicates that the Structures Monitoring Program manages loss of material for steel structural components. The applicant also stated that for some components, the Structures Monitoring Program is supplemented by the Fire Protection Program. The applicant further stated that other components are managed by the PSPM, Fire Protection, or Fire Water System programs.

The staff was not clear how the above programs satisfy the recommendations of the Structures Monitoring Program. Therefore, RAI 3.5.2.2.2.6-1, dated August 28, 2009, was issued asking the applicant to explain how the above mentioned AMPs meet or exceed the inspection requirements of the Structures Monitoring Program.

By letter dated September 24, 2009, the applicant explained that the Structures Monitoring Program manages loss of material through visual inspection of component surface condition at a frequency of at least once every five years. The acceptance criteria include no indications of loss of material, such as excessive rust or corrosion. The applicant further explained that the identified supplemental programs employ the same inspection method, comparable frequencies, and the same acceptance criteria. The applicant indicated that the parameter monitored for loss of material in all four programs is the condition of component external surfaces.

The staff reviewed the applicant’s response and found it acceptable. All of the supplemental programs employ inspection methods, frequencies, and acceptance criteria which meet or exceed the criteria discussed in the GALL Report recommended AMP. The staff finds that the criteria of the SRP-LR Section 3.5.2.2.2.6, item 1, have been met, and no further evaluation is required. The staff’s review of the Fire Protection, Fire Water System, and PSPM programs are documented in SER Section 3.0.3.

(2) Reduction in Concrete Anchor Capacity due to Degradation of the Surrounding Concrete for Groups B1 through B5 Supports

LRA Section 3.5.2.2.2.6, item 2 indicates that plant experience has not identified reduction in concrete anchor capacity or other concrete aging mechanisms. The applicant further stated that the Structures Monitoring Program will confirm the absence of aging effects and CNS concrete anchors and surrounding concrete are included in the Structures Monitoring Program.

The staff noted that the GALL Report, generic item T-29, discusses grouted anchors, but the LRA does not mention grout. Therefore, RAI 3.5.2.2.2.6-2 dated August 28, 2009, was issued to ask the applicant to explain whether or not grout and grouted anchors were covered by the Structures Monitoring Program.

By letter dated September 24, 2009, the applicant explained that grout pads and structural grout are sub-components of concrete and are included with concrete components. The applicant also stated that grout and grouted supports are included with the concrete bulk commodity “equipment pads/foundations,” and are included in the scope of the Structures Monitoring Program.

The staff reviewed the applicant’s response and found it acceptable, since grout and grouted supports are included within the scope of the GALL Report recommended Structures Monitoring Program. The staff finds that the criteria of SRP-LR Section 3.5.2.2.2.6, item 2, have been met, and no further evaluation is required. The staff’s review of the Structures Monitoring Program is documented in SER Section 3.0.3.

(3) Reduction/Loss of Isolation Function Due to Degradation of Vibration Isolation Elements for Group B4 Supports - LRA Section 3.5.2.2.2.6, item 3 indicates that the CNS AMR did not identify any component support structure/aging effect combination corresponding to NUREG-1801 Volume 2 item III.B4.2-a.

The staff was unclear whether or not vibration isolation elements exist at CNS within the scope of license renewal, or whether the applicant believes in-scope isolation elements have no aging effect. RAI 3.5.2.2.2.6-3, dated August 28, 2009, was issued asking the applicant to clarify the meaning of LRA Section 3.5.2.2.2.6, item 3.

By letter dated September 24, 2009, the applicant explained that vibration isolation elements are not uniquely identified because they are an integral part of the overall structural support component. The applicant further stated that aging management activities for managing the entire structural support assembly under the Structures Monitoring Program will manage the effects of aging on these vibration isolation elements.

The staff reviewed the applicant’s response and found it acceptable, because the vibration isolation elements are included within the scope of the GALL Report recommended Structures Monitoring Program. The staff finds that the criteria of SRP-LR Section 3.5.2.2.2.6, item 3 have been met, and no further evaluation is required. The staff’s review of the Structures Monitoring Program is documented in SER Section 3.0.3.

Based on the programs and analysis identified above, the staff concludes that the applicant’s programs meet 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, in accordance with 10 CFR 54.21(a)(3).

3.5.2.2.2.7 Cumulative Fatigue Damage. LRA Section 3.5.2.2.2.7 indicates that TLAAs are evaluated in accordance with 10 CFR 54.21(c) as documented in Section 4. No fatigue analyses were identified for component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3.

SRP-LR Section 3.5.2.2.2.7 states that if a CLB fatigue analysis exists, a TLAA, as defined in 10 CFR 54.3, should be evaluated in accordance with 10 CFR 54.21(c). This evaluation is addressed separately in Section 4.3, "Metal Fatigue Analysis."

The staff's review of the applicant's TLAA is documented in SER Section 4.3.

3.5.2.3 AMR Results That Are Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.5.2-1 through 3.5.2-4, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

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 functions will be maintained consistent with the CLB for the period of extended operation. The staff's evaluation is documented in the following sections.

3.5.2.3.1 Steel, Aluminum, Concrete, Crushed Rocks, Treated Wood, Fiber Glass, Cerafiber, Elastomers, and PVC Exposed to Fluid, Air, or Soil Environment (Overview of LRA Table 3.5.2-1 to Table 3.5.2-4)

The staff reviewed LRA Tables 3.5.2-1 to 3.5.2-4, which summarize the results of AMR evaluations as follow.

In LRA Tables 3.5.2-1 to 3.5.2-4, the applicant identified 228 component/material/environment/aging effect/AMP groups. There are 164 that have AMR results consistent with the GALL Report, as identified by reference to LRA Notes A through E. The staff confirmed that the references to Table 1 and GALL Report, Volume II, line items are appropriate.

For 30 groups, the applicant proposed to manage aging of reinforced concrete (GALL Report items III.A1-2, III.A1-4, III.A6-2, III.A6-7, III.A3-2, III.A3-3, and III.A3-4, SRP-LR Items 3.5.1-27, 3.5.1-28, 3.5.1-31, 3.5.1-36, 3.5.1-45), with the Structures Monitoring Program. The applicant assigned these line items no aging effect and referenced LRA Note I and Plant-Specific Note 501, which states "The CNS environment is not conducive to the aging effects listed in NUREG-1801. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3. The staff finds that the credited AMP is appropriate because the Structures Monitoring Program performs visual inspections on a periodic basis to manage any degradation (e.g., cracking, loss of material, etc) and it is the recommended program in the referenced GALL Report line items. Since the applicant has committed to an appropriate AMP for the period of extended operation, the staff finds these AMR results to be acceptable for these groups.

For 16 groups, the applicant proposed to manage aging of reinforced concrete (GALL Report items VII.G-28, VII.G-30, and III.A6-3, SRP-LR Item 3.3.1-65, 3.3.1-66, and 3.5.1-34 respectively), with the Structures Monitoring Program and Fire Protection Program. The applicant assigned these line items no aging effect and referenced LRA Note I and Plant-Specific LRA Note 501, which states "The CNS environment is not conducive to the aging effects listed in NUREG-1801. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." For these items, the Structures

Monitoring Program and Fire Protection Program have been identified as the AMPs to manage the effects of loss of material. The staff's review of the Structures Monitoring Program and the Fire Protection Program are documented in SER Section 3.0.3. The staff finds that the credited AMPs are appropriate because the Structures Monitoring Program and the Fire Protection Program perform visual inspections on a periodic basis to manage any degradation (e.g., cracking, loss of material, etc.) and they are the recommended programs in the referenced GALL Report line items. Since the applicant has committed to appropriate AMPs for the period of extended operation, the staff finds these AMR results to be acceptable for these groups.

For two groups, the applicant proposed to manage the loss of form of crushed rock material in outdoor air or soil by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3. These line items reference LRA Note J, which states that neither the component nor the material and environment combination is evaluated in the GALL Report. The staff finds that the credited AMP is appropriate because the Structures Monitoring Program performs visual inspections on a periodic basis to manage loss of form. Since the applicant has committed to appropriate AMPs for the period of extended operation, the staff finds these AMR results to be acceptable for these groups.

For four groups, the applicant proposed to manage loss of material and change in material properties of treated wood material by using the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3. These line items reference LRA Note J which indicates that neither the component nor the material and environment is evaluated in the GALL Report. The staff finds that the credited AMP is appropriate because the Structures Monitoring Program performs visual inspections on a periodic basis to manage loss of material and change in material properties. Since the applicant has committed to an appropriate AMP for the period of extended operation, the staff finds these AMR results to be acceptable for these groups.

For one group, the applicant proposed to manage wood, sand bags, sealant (flood retention [spare parts] materials), with no aging effect, by using the Structures Monitoring Program. These line items reference LRA Note I and plant-specific Note 501, which states "The CNS environment is not conducive to the aging effects listed in NUREG-1801. However, the identified AMP will be used to confirm the absence of significant aging effects for the period of extended operation." The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3. The staff finds that the credited AMP is appropriate because the Structures Monitoring Program performs visual inspections on a periodic basis, commensurate with industry guidance and operating experience, to manage any degradation (e.g., cracking, loss of material, etc). Since the applicant has committed to an appropriate AMP for the period of extended operation, the staff finds these AMR results to be acceptable for this group.

3.5.2.3.2 Stainless Steel Support and Connection Component Groups Exposed to Air-Outdoor

LRA Table 3.5.2-4 lists the aging effect and AMP as none for five stainless steel support and connection component groups exposed to an "air-outdoor" environment. The AMR line items cite LRA Note I and Plant-Specific Note 503, which indicates that aging management is not required because the ambient environment at CNS is not chemically polluted.

The staff reviewed the AMR lines and found that the components matched GALL Report, generic item TP-6, which says stainless steel support members and bolted connections in an outdoor environment should be monitored by the Structures Monitoring Program. The staff did not agree with the applicant's claim that the aging effect in the GALL Report is not applicable to these components. To address this, the staff issued RAI 3.5.2.3-1, by letter dated August 28, 2009.

By letter dated September 24, 2009, the applicant responded and explained that industry experience has shown that stainless steel is very resistant to general corrosion for both interior and exterior exposures and under conditions of high or low humidity. The applicant further stated that CNS is located in a predominantly agricultural environment, and not located near seawater or significant industrial plants which could result in an aggressive air-outdoor environment. Based on this, the applicant explained that the conditions necessary to cause loss of material for stainless steel elements exposed to an air-outdoor environment do not exist at CNS. However, the applicant explained that the Structures Monitoring Program includes inspections of the five stainless steel support and connection component groups in an air-outdoor environment, with the exception of ASME Code Class 1, 2, 3, and main condensate supports bolting, which is included in the ISI – IWF Program.

The staff reviewed the applicant's response and found it acceptable, because the five component groups of concern are being inspected under the GALL Report recommended Structures Monitoring Program.

On the basis of its review of the AMR lines discussed in the preceding paragraphs, including the RAI response, and its comparison of the applicant's results to corresponding recommendations in the GALL Report, the staff finds that the applicant addressed the AERMs adequately.

3.5.2.3.3 Cracking, Delamination, and Separation for Elastomer and Cera Blanket Fire Stops and Fire Wraps Exposed to Indoor Uncontrolled Air

In LRA Table 3.5.2-4, the applicant proposed to manage cracking, delamination, and separation for elastomer and cera blanket fire stops exposed to an indoor uncontrolled air environment by using the Fire Protection Program. The AMR line item cites LRA Note J, which indicates that neither the component nor the material and environment combination is evaluated in the GALL Report.

The staff's evaluation of the Fire Protection Program is documented in SER Section 3.0.3. The staff verified that the Fire Protection Program performs visual inspections to manage cracking, delamination, and separation of elastomers and cera blanket fire stops. On the basis that periodic visual inspections are performed, the staff finds the applicant's use of the Fire Protection Program to be acceptable.

On the basis of its review, 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 functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.5.2.3.4 Aluminum Air-Outdoor (External/Internal)

In LRA Tables 3.5.2-3 and 3.5.2-4, the applicant identified that there was no aging effect requiring management or an AMP for the aluminum diesel fuel tank hatch cover, vents, and louvers in an outdoor environment. The AMR line items cite LRA Note I, which indicates that the aging effect in the GALL Report for this component, material and environment is not applicable. The applicant listed Plant Specific Note 503 which states that the ambient environment at CNS is not chemically polluted by vapors of sulfur dioxide or other similar substances and the external environment does not contain saltwater or high chloride content. Therefore, the applicant concluded that aging management is not required for aluminum and stainless steel components exposed to the external environment. The applicant defines an air outdoor environment as air temperature less than 115 °F and humidity up to 100 percent. There is no aging effect to the aluminum because there are not high levels of contaminants in the outdoor environment that will degrade the material.

In reviewing the industry operating experience, the staff notes that loss of material may occur when aluminum is exposed to high humidity and contaminated environments for long durations. The staff notes that the ambient environment at CNS does not contain high chloride content, or other contaminants which may cause corrosion of aluminum materials. Therefore, 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 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, in accordance with 10 CFR 54.21(a)(3).

3.5.2.3.5 Steel Piles in Soil

In response to RAI 2.4-8, dated August 13, 2009, the applicant revised LRA Table 3.5.2-3 to include a line item for carbon steel piles in a soil environment. The AMR line item cites LRA Note I and Plant Specific Note 505, which indicates that aging management is not required because “steel piles driven into undisturbed soils are unaffected by corrosion and steel piles driven into disturbed soils have experienced only minor to moderate corrosion that does not significantly affect continued safety function performance during the license renewal term.”

The staff reviewed the applicant’s additional AMR line item and found it acceptable because industry experience supports the conclusion that steel piles driven in undisturbed soils have been unaffected by corrosion, and those driven in disturbed soils experience only minor corrosion in small areas. This conclusion is also documented in Table B-9 of NUREG-1557.

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 functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.6 Loss of Material from Cera Fiber and Cera Blanket

The materials being reviewed are ceramics made from blend of silica and alumina) exposed to uncontrolled indoor air. Note, this material is used to wrap around the pipes and electrical raceways as a fire barrier.

LRA Table 3.5.2-4 addresses bulk commodities including fire stops and fire wrap with an intended function of fire barrier; a material of cera blanket, cera fiber, and elastomers; an environment of air – indoor uncontrolled; aging effects of cracking, delamination, separation and loss of material; all of which are managed by the Fire Protection Program.

The staff evaluated the fire stop and fire wrap commodities and noted that these items are typically made of ceramics or other inorganic material and are used as fire barriers to protect pipes and electrical raceways during a fire event. The staff noted that cera fiber and cera blanket materials are listed in the LRA with a footnote J, which indicates neither the component nor the material-environment combination is evaluated in the GALL Report. The staff agreed with the applicant's commodity, intended function, material, environment, aging effect, and aging management program combination.

The staff reviewed the applicant's Fire Protection Program and its evaluation is documented in SER Section 3.0.3. The staff noted that the applicant's Fire Protection Program includes periodic visual inspections of fire barriers such as fire barrier penetration seals, fire stops and fire wraps. The staff noted that gross degradation (e.g., cracking, delamination and/or separation) of cera fiber and cera blankets would be visible from outside. The staff further noted that it is a common practice to examine the material condition of industrial fire barriers during routine inspections. The staff finds that cracking/delamination, separation, and loss of material of cera fiber and cera blankets can therefore be adequately managed by periodic visual inspection. The staff noted that the applicant has identified an appropriate program to manage the aging effects of cera fiber and fire blankets.

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 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).

3.5.2.3.7 Plastics, Air-Indoor Uncontrolled

In LRA Tables 3.5.2-4, the applicant did not identify an aging effect requiring management or AMP for PVC water stops in an indoor air (uncontrolled) environment. The AMR line items cite LRA Note J which indicates that neither the component nor the material and the environment combination is evaluated in the GALL Report.

The applicant's definition of indoor air (uncontrolled) environment as stated in the LRA states, "Air with temperature less than 150°F, humidity up to 100% and protected from precipitation." The staff finds this acceptable because PVC material has a melting point range and glass transition temperature greater than the temperature limit of 150°F for indoor air (uncontrolled) environment. Furthermore, the component is not exposed to UV radiation. Therefore, the staff agrees that there will be no aging effect for PVC water stops in this environment.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has not 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).

3.5.3 Conclusion

On the basis of its review, the staff concludes that the applicant has 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 functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.6 Aging Management of Electrical and Instrumentation and Controls

The following information documents the staff's review of the applicant's AMR results for the electrical and instrumentation and control (EIC) components and component groups of:

- non-EQ insulated cables and connections
- metal-enclosed bus
- high-voltage insulators
- switchyard bus and connections
- transmission conductors and connections

3.6.1 Summary of Technical Information in the Application

LRA Section 3.6 provides AMR results for the EIC components and component groups. LRA Table 3.6.1, "Summary of Aging Management Programs for the EIC Components Evaluated in Chapter VI of NUREG-1801," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the EIC components and component groups.

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 EIC 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, in accordance with 10 CFR 54.21(a)(3).

The staff reviewed AMRs to ensure the applicant's claim that certain AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant has identified the appropriate GALL Report AMPs. The staff's evaluations of the AMPs are documented in SER Section 3.0.3. Details of the staff's evaluation are documented in SER Section 3.6.2.1.

The staff also reviewed AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with SRP-LR Section 3.6.2.2 acceptance criteria. The staff's evaluations are documented in SER Section 3.6.2.2.

The staff also verified that the applicant did not have any AMRs that were not consistent with, or not addressed in, the GALL Report.

3.6.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.6.2.1 identifies the materials, environments, aging effects requiring management, and the following programs that manage aging effects for the EIC components:

- Metal-Enclosed Bus Inspection
- Non-EQ Bolted Cable Connections
- Non-EQ Inaccessible Medium-Voltage Cable

- Non-EQ Instrumentation Circuits Test Review
- Non-EQ Insulated Cables and Connections

In LRA Table 3.6.2-1, the applicant summarized AMRs for the EIC components and claimed that these AMRs are consistent with the GALL Report.

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

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

The staff reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the EIC components that are subject to an AMR. On the basis of its review, the staff determines that, for AMRs not requiring further evaluation, as identified in LRA Table 3.6.1, the applicant's references to the GALL Report are acceptable and no further staff review is required.

3.6.2.1.1 Loss of Material due to General Corrosion of Metal-Enclosed Bus

In the discussion column in LRA Table 3.6.1, the applicant indicated that the Metal-Enclosed Bus Inspection Program will manage the effects of loss of material due to general corrosion through visual inspection. The staff noted that in Table 3.6.2-1, AMR results line that points to Table 3.6.1, item 3.6.1-9, the applicant included a reference to LRA Note E.

The staff reviewed the AMR results line referenced to Note E and determined that the component type, material, environment, and the aging effects are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends the AMP XI.S6, "Structures Monitoring Program," the applicant has proposed the Metal-Enclosed Bus Inspection Program. As discussed in SER Section 3.0.3, the staff found that using visual inspections, as described in the Metal-Enclosed Bus Inspection Program, is acceptable to inspect the outside of metal-enclosed bus enclosure assemblies for loss of material due to general corrosion.

On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are indeed consistent. Therefore, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.6.2.1.2 Hardening and Loss of Strength Due to Elastomer Degradation of Metal-Enclosed Bus

In the discussion column in LRA Table 3.6.1, the applicant indicated that the Metal-Enclosed Bus Inspection Program will manage the effects of hardening and loss of strength of elastomer through visual inspections for cracking and flexing of the elastomer for flexibility. The staff noted that in the AMR results line that points to Table 3.6.1, item 3.6.1-10, the applicant included a reference to LRA Note E.

The staff reviewed the AMR results line referenced to LRA Note E and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends the AMP XI.S6, "Structures Monitoring Program," the applicant has proposed the Metal-Enclosed Bus Inspection Program. As discussed in SER Section 3.0.3, the staff found visual inspection and flexing of elastomer as described in the Metal-Enclosed Bus Inspection Program acceptable to inspect the metal-enclosed bus elastomer degradation.

The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's proposals for managing aging effects. On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are indeed consistent. Therefore, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

3.6.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

3.6.2.2.1 Electrical Equipment Subject to Environmental Qualification

Electrical EQ is a TLAA. The staff evaluation is in SER Section 4.4.

3.6.2.2.2 Degradation of Insulator Quality Due to Salt Deposits or Surface Contamination, Loss of Material Due to Mechanical Wear

LRA Section 3.6.2.2.2 states that various airborne materials (e.g., dust, salt, and industrial effluents) can contaminate insulator surfaces. The applicant indicated that buildup of surface contamination is gradual and in most areas is washed away by rain. The glazed insulator surface aids this contamination removal. The applicant also stated that surface contamination can be a problem in areas where there are greater concentrations of airborne particles, such as near facilities that discharge soot or near the seacoast where salt spray is prevalent. The applicant further stated that CNS is not located near the seacoast or near other sources of airborne particles. The applicant concluded that surface contamination is not an applicable aging effect for high-voltage insulators at CNS.

The applicant also stated in LRA Section 3.6.2.2.2 that mechanical wear is an aging effect for strain and suspension insulators subject to movement. The applicant also stated that although this mechanical wear is possible, industry experience has shown transmission conductors do not normally swing, and when subject to a substantial wind, movement will subside after a short period. The applicant further stated that wear has not been apparent during routine inspections and is not a credible aging effect.

The staff reviewed LRA Section 3.6.2.2.2 against the criteria in SRP-LR Section 3.6.2.2.2 which states that degradation of insulator quality due to salt deposits or surface contamination may occur in high-voltage insulators. The GALL Report recommends further evaluation of plant-specific AMPs for plants at locations of potential salt deposits or surface contamination (e.g., in the vicinity of salt water bodies or industrial pollution). Loss of material due to mechanical wear caused by wind on transmission conductors may occur in high-voltage insulators. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

During the audit, the staff reviewed Significant Condition Report (SCR) 2003-1844 and noted that on October 28, 2003, a pole fire on a cross arm between the 345-kV subyard and main unit transformer occurred. As a result of the fire, the southern end of the beam or cross member burned through allowing the C phase to drop, but remained suspended above the ground. The southern insulator on the disconnect switch was damaged. Differing voltage potential at the cold end of the insulator strings (attached to the cross arm) facilitated stray electrical current from phase to phase or from phase to ground in the cross arm. Dust and fiber particles from the harvesting of soybeans and disc operation of the adjacent farm field near the switchyard, settled on the exterior surface of the insulator bells and became wetted during heavy fog or light rain/mist conditions. This contamination with light moisture caused leakage current across the insulators, which resulted in a fire. The staff also noted that a similar fire occurred in the CNS switchyard on the 345-kV Booneville wooden structure in 1997 due to insulator contamination. Sea salt or dust collection on high-voltage insulators and cross arms in the presence of light rain or moisture can form a film on the insulators and create a conductive path allowing electricity to flow. A small amount of electricity can leak through this path and reach the wooden cross arm causing it to burn. Therefore, in a letter dated July 14, 2009 (RAI 3.6-1), the staff requested the applicant to explain why degradation of insulator quality due to surface contamination from dust and fiber particles is not an aging effect requiring management at CNS.

In a letter dated August 13, 2009, the applicant responded that the 2003 condition was event driven and its root cause was addressed through a design modification. The applicant indicated that the identified condition did not involve a degradation of insulator quality. The light surface contamination identified in this event did not cause arcing across the insulator or flashover, as has been observed in other industry OE, such as in coastal plants. The applicant also indicated that it is common to have a small amount of leakage current across a high-voltage insulator, which allows a charge to build up on the cold end of the insulator if the insulator is not properly grounded. On a steel structure, this ground path is intrinsic to the structure. On a wooden structure, the ground path has been added by design. The applicant further indicated that according to the root cause report, surface contamination buildup on the 345-kV high-voltage insulators caused by high humidity coupled with airborne corn/soybean particles during harvest, allowed a charge to build up on the cold end of the high-voltage insulator string due to corona. Additionally, the applicant indicated that the combination of these conditions is a rare event that can occur independent of the age of the affected insulators. The applicant also indicated that, by itself, corona does not typically cause sufficient heat to generate a fire. The applicant indicated that the root cause evaluation determined that cracks in the cross arm were filled with moisture and dust/fiber particles. The natural resistance in the cross arm material generated enough heat to cause a fire. A similar event has occurred on other NPPD 345-kV poles with cross arms, such as in the NPPD switchyard at CNS on the 345-kV Booneville wooden structure in 1997. Cross arm fires on 345-kV wooden structures in the NPPD system were eliminated by bonding a grounding conductor to the cold end insulator string, across the top of the cross arms, and down the pole. The applicant also stated that this provided a safe path to ground for the stray currents created by these conditions. In summary, the applicant indicated that the 2003 event was due to the fact that the pole structure was not properly grounded, thus allowing stray voltages to build up on the high-voltage insulator cold end resulting in enough heat to ignite the wooden pole cross arm. By properly grounding the cold end, the voltage potential that could be caused by corona from a similar event would be harmlessly drained to ground. The incident was event driven as a design deficiency, not an aging issue. The applicant concluded that the surface contamination from dust and fiber particles on high-voltage insulators is not an aging effect requiring management for the period of extended operation.

The staff has reviewed the applicant's response and requested the applicant to clarify its conclusion that the incident was event driven as a design deficiency not an aging issue. The staff noted that surface contamination could buildup on the 345 kV high-voltage insulators and high humidity coupled with airborne corn/soybean particle during harvest could enable the conductor voltage to track along the insulator surface more easily and could potentially lead to insulator flashover. The buildup of surface contamination is gradual and in most areas such contamination is washed away by rain. However, a large buildup of contamination could enable the conductor voltage to track along the surface more easily. Surface contamination can be a problem in areas where there are greater concentrations of airborne particles such as near corn/soybean fields. Dust collection on high-voltage insulators in the presence of light rain or moisture can form a film on the insulators and create a conductive path allowing electricity to flow. A small amount of electricity can leak through this path and reach the wooden cross-arm causing it to burn. Degradation of insulator quality due to the presence of dust buildup near the corn/soybean farms could be an applicable aging effect requiring management. The staff requested the applicant to justify why surface contamination to high-voltage insulator is not an applicable aging effect requiring management at CNS.

In a letter dated November 30, 2009, the applicant clarified that the event at CNS was not a flashover event. The airborne contaminants did not create a flashover event, but did contribute combustible material. Due to inadequate grounding of the insulator, the normal leakage current from the corona created a hotspot at the cold end of the insulator. The corn/soybean dust particles contributed to combustion near the hotspot. The applicant also stated that the design corrected the inadequate grounding, so the normal leakage current from the corona will no longer create a hotspot at the cold end of the insulator. Without a heat source, the dust from harvesting will not combust. The applicant further stated that this is different from high-voltage insulator flashover at coastal plants associated with salt spray. The salt spray forms a film on the insulator and creates a conductive path allowing electricity to flow from the conductor over the surface of the insulator. The applicant also stated that this current is distinct from the normal leakage current from the corona. The salt spray contamination events cause flashover, not just heating at the cold end of the insulator. The dust event at CNS did not create a flashover or arcing event because a conductive path allowing electricity to flow was not created. Therefore, the applicant concluded that there is no aging effect requiring management.

In addition, the applicant stated that the event on the 345 kV towers, which are not in-scope of license renewal, is not applicable to the 161 and 69 kV towers and high voltage insulators that are in-scope of license renewal for CNS. The applicant stated that harvesting operations typically occur once per year in nearby fields, however, this frequency is nonconsequential as precipitation removes harvest dust from the insulators. The applicant further stated that the dust from harvests is not excessive and there is no OE at CNS or in the industry that suggests that this environment will contaminate high-voltage insulators and lead to flashover or arcing.

The staff reviewed the applicant's further clarification and finds it acceptable. The staff finds it acceptable based on:

(1) The event on the 345-kV towers is not applicable to the 161 and 69 kV towers and high voltage insulators that are in-scope of license renewal. Corona is a phenomenon associated with energized transmission lines. Under certain conditions, the localized electric field near an energized conductor can be sufficiently concentrated to produce a

tiny electric charge that can ionized air close to the conductors (Electric Power Research Institute , 1982, Transmission Line Reference Book: 345 kV and Above, Second Edition). Several factor, including conductor voltage, shape and diameter, and surface irregularities such as scratches, nicks, dust, or water drops can affect a conductor's electrical surface gradient and its corona performance. Corona is the physical manifestation of energy loss, and can transform discharge energy into very small amount of sound, radio noise, heat, and chemical reaction of the air components. Corona is usually one of the major factors in transmission line design for extra high voltage transmission lines (345 to 765 kV). Corona is usually not an issue for power line rated at 230 kV and lower.

(2) The applicant provided an explanation of why the airborne contaminants did not create a insulator flashover event, but rather contributed as combustible material; the applicant also made a design change to ground the cold end insulator, so the normal leakage current from the corona will flow from the cold end insulator to ground, eliminating the heat source that would combust airborne contaminants.

(3) The event at CNS is different from high-voltage insulator flashover typically at coastal plants associated with salt spray which forms a film on the insulators and creates a conductive path allowing electricity to flow from the conductor over the surface of the insulator. This is different from the normal leakage current from the corona.

(4) Harvesting operations is only occurs once per year. This frequency is insignificant for the buildup of surface contamination as precipitation normally removes dust from the insulators. The glazed insulator surface also aids this contamination removal.

Therefore, the staff finds that the incident was event driven as a design deficiency, not an aging issue. The staff concludes that surface contamination is not an aging effect requiring management for the insulators at CNS.

The staff determines that, although loss of insulator material due to mechanical wear is possible, transmission conductors do not swing under normal operating conditions. In addition, if substantial wind does cause transmission conductors to swing, they do not swing very long once the wind has subsided. Wind loading that can cause a transmission line and insulators to vibrate or sway is considered in the design and installation. In addition, the applicant has not identified any wear of insulators during routine inspections. Furthermore, transmission conductors within the scope of license renewal are short spans (connecting the switchyard to startup transformers) and the surface area exposed to wind loads are not significant. Based on its review, the staff finds that mechanical wear aging effect of high-voltage insulators is not an aging effect requiring management.

Based on the review above, the staff concludes that the applicant has met the SRP-LR Section 3.6.2.2.2 criteria. For those line items that apply to LRA Section 3.6.2.2.2, the staff determines that the 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, in accordance with 10 CFR 54.21(a)(3).

3.6.2.2.3 Loss of Material Due to Wind-Induced Abrasion and Fatigue, Loss of Conductor Strength Due to Corrosion, and Increased Resistance of Connection Due to Oxidation or Loss of Pre-Load

LRA Section 3.6.2.2.3 states that wind loading that can cause a transmission line and insulators to vibrate is considered in the design and installation. The applicant indicated that operation of active switchyard components is also a potential contribution to vibration and resulting wear. However, the switchyard bus is connected to active equipment by short sections of flexible conductors. The flexible conductors are part of the switchyard bus commodity group. The applicant also stated that vibration is not applicable since flexible conductors connecting the switchyard bus to active components eliminate the potential for vibration. The applicant further indicated that a review of industry OE, plant-specific OE, and NRC generic communications related to the aging of transmission conductors ensured that no additional aging effects exist beyond those previously identified.

The applicant also stated that the most prevalent mechanism contributing to loss of conductor strength of an aluminum conductor steel reinforced (ACSR) transmission conductor is corrosion, which includes corrosion of the steel core and aluminum strand pitting. For ACSR conductors, degradation begins as a loss of zinc from the galvanized steel core wires. The applicant further stated that corrosion in ACSR conductors is a very slow-acting aging mechanism with the corrosion rates depending largely on air quality. Air quality factors include suspended particle chemistry, sulfur dioxide (SO_2) concentration, and meteorological conditions. The applicant also stated that air quality in rural areas, such as the area surrounding CNS, generally contains low concentrations of suspended particles and SO_2, which minimizes the corrosion rate. Tests performed by Ontario Hydroelectric showed a 30 percent loss of composite conductor strength of an 80-year old ACSR conductor due to corrosion.

The applicant indicated that the CNS service station standby transformer's (SSST) high-voltage side is connected to the 161-kV switchyard via overhead transmission lines. The 161-kV overhead transmission conductors are 886.4 thousand circular mils (MCM) 26/4 ACSR. The CNS ESST's high-voltage side is connected to the 69-kV switchyard via an overhead transmission line. Two sections of the 69-kV overhead transmission conductors are 4/0 American wire gauge (AWG) 6/1 ACSR, and the third section is 397.5 MCM 26/7 ACSR. The applicant also stated that the 4/0 ACSR transmission conductor as tested in the Ontario Hydroelectric test, as documented in the companion paper, "Aged ACSR Conductors, Part II–Prediction of Remaining Life," bounds the CNS transmission conductors.

The applicant further stated that the National Electrical Safety Code (NESC) requires that tension on installed conductors be a maximum of 60 percent of the ultimate conductor strength. The NESC also specifies the maximum tension a conductor must be designed to withstand under heavy load requirements, which includes consideration of ice, wind, and temperature. The applicant also states that evaluation of the conductor type with the smallest ultimate strength margin (4/0 ACSR) illustrates the conservative nature of the design of transmission conductors at CNS. The ultimate strength and the NESC heavy load tension requirements of 4/0 ACSR (212 MCM) are 8,350 lbs and 2,761 lbs respectively. The margin between the NESC heavy load and the ultimate strength is 5,589 lbs (i.e., there is a 67 percent of ultimate strength margin). The Ontario Hydroelectric study showed a 30 percent loss of composite conductor strength in an 80-year old conductor. In the case of the 4/0 ACSR transmission conductors, a 30 percent loss of ultimate strength would mean that there would still be a 37 percent ultimate strength margin between what is required by the NESC and the actual conductor strength after 80 years of service. The 4/0 ACSR conductor type has the lowest initial design margin of in-scope CNS transmission conductors. The applicant further stated that this illustrates with reasonable assurance that transmission conductors will have ample strength through the period of extended operation. The applicant also stated that a review of industry OE and NRC generic communications related to the aging of transmission conductors ensured that no additional aging effects exist beyond those previously identified and a review of plant-specific OE did not identify any unique aging effects for transmission conductors at CNS.

The applicant indicated that corrosion due to surface oxidation for welded aluminum switchyard bus is not applicable. Increased connection resistance due to surface oxidation is a potential effect, but is not significant enough to cause a loss of intended function. The applicant indicated that at CNS, switchyard connection surfaces are coated with an antioxidant compound (i.e., a grease-type sealant) prior to tightening the connection to prevent the formation of oxides on the metal surface and to prevent moisture from entering the connections, thus minimizing the potential for corrosion. The applicant further indicated that based on CNS and industry OE, this method of installation provides a corrosion-resistant low electrical resistance connection.

The applicant indicated that the switchyard component connections are included in the infrared inspection of the 161-kV switchyard connections, which verifies the effectiveness of the connection design and installation practices. CNS performs infrared inspection of the 161-kV switchyard components and transformer yard connections as part of a periodic preventive maintenance task to verify the integrity of the connections. The applicant further indicated that this inspection and plant-specific OE verifies that increased connection resistance aging effects is not significant for CNS.

The applicant indicated that increased connection resistance due to loss of pre-load (torque relaxation) for switchyard connections is not an aging effect requiring management. The design of the transmission conductor and switchyard bus bolted connections precludes torque relaxation as confirmed by plant-specific OE. The CNS OE report did not identify any failures of switchyard connections. The applicant also indicated that the design of switchyard bolted connections includes Belleville washers and an antioxidant compound (i.e., a grease-type sealant). The type of bolting plate and the use of Belleville washers is the industry standard to preclude torque relaxation. The applicant further indicated that this, combined with the proper sizing of the conductors, eliminates this aging mechanism.

The staff reviewed LRA Section 3.6.2.2.3 against the criteria in SRP-LR Section 3.6.2.2.3 which states that loss of material due to wind induced abrasion and fatigue, loss of conductor strength due to corrosion, and increased resistance of connection due to oxidation or loss of pre-load could occur in transmission conductors and connections, and in switchyard bus and connections. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed.

The staff noted that the sections of transmission conductor, in the scope of license renewal, are short spans connecting the switchyard to the startup transformers and the surface areas exposed to wind loads are not significant. The flexible conductors eliminate potential for vibration, and wear is not an applicable aging effect because the flexible conductors are welded to the switchyard buses. Furthermore, the applicant confirmed that plant-specific OE did not identify any aging effects of mechanical wear of transmission conductors. Based on this information, the staff determined that loss of material of transmission conductors due to vibration is not an aging effect requiring management.

The staff reviewed the test report, titled “Aged ACSR Conductors, Part II–Prediction of Remaining Life,” performed by Ontario Hydroelectric to determine whether CNS transmission conductors have adequate design margin to perform their intended function during the extended period of operation. Samples of conductors were removed from 44 lines across the Ontario province and the individual wires were tested in tension. The strength, as a percent of rated tensile strength, is plotted against age for each sample. The study showed about 30 percent loss of conductor strength of 80-year old ACSR conductors due to corrosion. The NESC requires that tension on installed conductors be a maximum of 60 percent of the ultimate conductor strength. The NESC also sets the maximum tension a conductor must be designed to withstand under heavy load requirements, which include consideration of a ½ inch of radial ice and 4 pounds per square feet (psf) of wind. The staff reviewed the requirements concerning the specific conductors included in the AMR at CNS. The applicant used the 4/0 ACSR conductor type to illustrate those transmission conductors at CNS are bounded by the Ontario Hydroelectric test. However, the applicant did not demonstrate that plant-specific transmission conductors at CNS would have adequate conductor strength to perform an intended function during the period of extended operation. Therefore, in a letter dated July 14, 2009 (RAI 3.6-2), the staff requested the applicant demonstrate that plant-specific transmission conductors will have adequate conductor strength design margin (after losing 30 percent of conductor strength due to corrosion) to perform intended functions during the period of extended operation.

In a letter dated August 13, 2009, the applicant responded that the following three types of ACSR conductors are used for in-scope transmission lines at CNS:

- 336.5 MCM 26/7 ACSR: [ultimate strength 14,050 lbs/heavy load 4,327 lbs] Initial design margin 69.2 percent
- 397.5 MCM 26/7 ACSR: [ultimate strength 16,190 lbs/heavy load 4,810 lbs] Initial design margin 70.3 percent
- 4/0 AWG (212 MCM) 6/1 ACSR: [ultimate strength 8,350 lbs/heavy load 2,761 lbs] Initial design margin 66.9 percent

The applicant indicated that a 4/0 ACSR (212 MCM) with a 6/1 stranding transmission conductor type has the lowest initial design margin in the NESC. Also, the 6/1 stranding (6 aluminum strands, and 1 galvanized steel strand) is the most susceptible to corrosion. The applicant also indicated that evaluation of the 4/0 ACSR conductor type shows the conservative nature of the design of transmission conductors. The applicant further indicated that it used the 4/0 ACSR transmission conductor to demonstrate reasonable assurance that the CNS transmission conductor will have ample strength through the period of extended operation.

The applicant indicated that NESC requires that tension on installed conductors be a maximum of 60 percent of the ultimate conductor strength. By NESC design, the minimum initial ultimate strength margin, including heavy loading requirement, is 40 percent. The applicant also stated that NESC also provides a method to calculate the maximum tension on a conductor under assumed heavy load conditions, which includes consideration of ice, wind, and temperature extremes. The NESC method was used for calculating the heavy load tension (the maximum tension loads of 4/0 ACSR are 8,350 lbs and 2,761 lbs, respectively). The applicant further stated that the margin between the maximum tension load and the ultimate strength is 5,589 lbs (8,350 lbs – 2,761 lbs = 5,589 lbs), which is 67 percent (5,589 lbs/8,350 lbs = 0.669) of ultimate strength, which exceeds the NESC initial design requirement of 40 percent for ultimate strength margin. The Ontario Hydroelectric study showed a 30 percent loss of composite conductor strength in an 80-year old conductor. The applicant indicated that in the case of the 4/0 ACSR transmission conductor, a 30 percent loss of ultimate strength would create an ultimate strength of 5,845 lbs [(8,350 lbs – (8,350 lbs x 0.3)]. With the maximum tension load of 2,761 lbs, there would still be (5,845 lbs – 2,761 lbs = 3,084 lbs; 3,084 lbs/5,848 lbs = 0.5276) 52.8 percent of ultimate strength margin, which exceeds the NESC initial design requirement of 40 percent of ultimate strength margin.

The applicant indicated that since the 4/0 ACSR conductor has the lowest initial design margin of transmission conductors in the scope of license renewal for CNS, all other conductors are bounded by this example. Because the 4/0 ACSR 6/1 conductor was included in the Ontario Hydroelectric study, the bounding value of a 30 percent loss of composite conductor strength in an 80-year old conductor is conservative for other conductors, since the single steel strand is more susceptible to corrosion. The applicant also stated that this illustrates with reasonable assurance that transmission conductors will have ample strength through the period of extended operation. The applicant further stated that a review of industry OE and NRC generic communications related to the aging of transmission conductors revealed that no additional aging effects exist beyond those identified. A review of the applicant's plant-specific OE did not identify any aging effects for transmission conductors. The applicant concluded that loss of conductor strength is not an aging effect requiring management for transmission conductors.

The staff finds the applicant's response acceptable. The applicant demonstrated that the 4/0 AWG transmission conductor will have ample strength through the period of extended operation. The staff verified that the remaining transmission conductors are bounded by those in the Ontario Hydroelectric study. This study showed a 30 percent loss of composite conductor strength in an 80-year old conductor. For 336.5 MCM and 397.5 MCM transmission conductors, the ratio between the heavy loading and the ultimate conductor strength (after losing 30 percent of conductor strength due to corrosion) is 44 percent and 42 percent, respectively [(4,327 lbs/14,050 lbs x 0.7) = 44 percent; 4,810 lbs/(16,190 lbs x 0.7) = 42 percent]. The NESC requires that the maximum tension of installed conductors shall not be more than 60 percent of the rated breaking strength under NESC design conditions. The ratio of maximum heavy load and the ultimate conductor strength of remaining installed conductors are below the 60 percent NESC requirements. Furthermore, the staff noted that the length of transmission conductors in-scope of license renewal is generally short span. These transmission conductors connecting the switchyard to the startup transformer provide restoration of offsite power after a SBO event. The loading of these transmission conductors is much less than the calculated heavy loading of a long span transmission line. Based on this information, the staff determined that loss of conductor strength due to corrosion of transmission conductor is not a significant aging effect requiring management for the period of extended operation. The staff determined that with a 30 percent loss of conductor strength, there is still ample margin between the NESC requirements and the actual conductor strength. Therefore, the staff's concern about loss of conductor strength due to corrosion is resolved.

The staff noted that the design of the transmission conductor bolted connections at CNS precludes torque relaxation and corrosion and the plant-specific OE has not identified any failures of switchyard connections due to aging. The type of bolting plates and the use of Belleville washers is the industry standard to preclude torque relaxation. CNS design incorporates the use of Belleville washers on bolted electrical connections of dissimilar metals to compensate for temperature changes, maintain the proper torque, and prevent loosening. This method of assembly is consistent with the good bolting practices recommended by industry guidelines (EPRI TR-104213, "Bolted Joint Maintenance & Application Guide"). The bolted connections and washers are coated with an antioxidant compound (a grease-type sealant) prior to tightening the connection to prevent the formation of oxides on the metal surface and to prevent moisture from entering the connection, thus reducing the chances of corrosion. This method of installation has been shown to provide a corrosion-resistant, low-electrical-resistance connection. In addition, the switchyard connections are included in the infrared predictive maintenance in the switchyard, which verify the effectiveness of the connection design and installation practices. The infrared predictive maintenance is performed periodically.

However, the staff noted that failures of Belleville washers (causing loose connections) were noted from industry OE, whereby hydrogen entrapment with plated steel washers caused embrittlement and stress cracking of the plated washer leading to loose connections. In addition, EPRI document TR-104213 also identifies this problem with Belleville washers. Therefore, in a letter dated July 14, 2009, the staff issued RAI 3.6-3 requesting the applicant to explain if electroplated Belleville washers are currently used at CNS. If Belleville washers are in use, the staff requested the applicant explain why hydrogen embrittlement is not a problem at CNS.

In its response to the staff's request, dated August 13, 2009, the applicant indicated that based on its onsite document, the Belleville washers used for the in-scope transmission conductor and switchyard bus electrical connections are either aluminum or stainless steel. The applicant also stated that since the aluminum or stainless steel Belleville washers are not electroplated, there is not a hydrogen embrittlement issue for electroplated Belleville washers for CNS. The applicant further stated that the switchyard component connections are included in the routine maintenance of the 161-kV and 69-kV switchyards, which verifies the effectiveness of the connection design and installation practices. The applicant concluded that these routine tasks verify the condition of the switchyard electrical connections for CNS.

The staff finds the applicant's response acceptable. Because electroplated Belleville washers are not used, hydrogen embrittlement is not an issue at CNS. The staff also finds that the applicant's current use of thermography to confirm the effectiveness of switchyard bolted connection to be acceptable. The staff's concern about the hydrogen embrittlement of electroplated Belleville washers is resolved.

Based on the review above, the staff concludes that the applicant has met the SRP-LR Section 3.6.2.2.3 criteria. For those line items that apply to LRA Section 3.6.2.2.3, the staff 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, in accordance with 10 CFR 54.21(a)(3).

3.6.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the EIC components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, in accordance with 10 CFR 54.21(a)(3).

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) and documents the staff review of that process. In Cooper Nuclear Station's (CNS's) license renewal application (LRA) Sections 4.2 through 4.7, the applicant addresses the plant's TLAAs. SER Sections 4.2 through 4.7 document the review of the TLAAs conducted by the staff of the United States Nuclear Regulatory Commission (NRC), or "the staff."

TLAAs are certain plant-specific safety analyses that involve time-limited assumptions defined by the current operating term. In accordance with Title 10, Section 54.21(c)(1), of the *Code of Federal Regulations* (10 CFR 54.21(c)(1)), the applicant is required to list TLAAs as defined in 10 CFR 54.3, "Definitions."

In addition, in accordance with 10 CFR 54.21(c)(2), the applicant is required to list existing plant-specific exemptions granted under 10 CFR 50.12, "Specific Exemptions," that are 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 analyses for CNS against the six criteria specified in 10 CFR 54.3. The applicant indicated that it has identified the analyses that met the six criteria by searching the current licensing basis (CLB). The CLB includes the updated safety analysis report (USAR), technical specifications (TSs) and bases, technical requirements manual, General Electric (GE) topical reports, fire protection program documents, inservice inspection program, NRC SERs, and docketed licensing correspondence. In LRA Table 4.1-1, "List of CNS TLAA and Resolution," the applicant listed the applicable TLAAs in the following categories:

- reactor vessel neutron embrittlement analyses
- metal fatigue analyses
- environmental qualification (EQ) analyses of electrical equipment
- concrete containment tendon prestress analyses
- containment liner plate, metal containment, and penetrations fatigue analyses
- other plant-specific TLAAs

In accordance with 10 CFR 54.21(c)(2), the applicant stated that it had identified no exemptions granted under 10 CFR 50.12 that were based on a TLAA, as defined in 10 CFR 54.3.

4.1.2 Staff Evaluation

LRA Table 4.1-1 lists the TLAAs the applicant identified as being applicable to CNS. The staff reviewed the information to determine whether the applicant had provided sufficient information in accordance with 10 CFR 54.21(c)(1) and 10 CFR 54.21(c)(2).

As defined in 10 CFR 54.3, TLAAs meet the following six criteria:

(1) involve systems, structures, and components (SSCs) within the scope of license renewal, in accordance with 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 SSC to perform its intended functions, in accordance with 10 CFR 54.4(b)

(6) are contained or incorporated by reference in the CLB

The applicant stated in the LRA that, to identify TLAAs, it used a process consistent with the guidance provided in NEI 95-10, “Industry Guideline for Implementing the Requirements of 10 CFR 54 – The License Renewal Rule,” Revision 6, June 2005, and reviewed lists of generic TLAAs in that document; the Generic Aging Lessons Learned (GALL) Report, Revision 1; Electric Power Research Institute (EPRI) Report TR-105090, “Guidelines to Implement the License Renewal Technical Requirements of 10 CFR 54 for Integrated Plant Assessments and TLAAs;” and SERs related to other boiling-water reactor (BWR) plant license renewal applications.

The staff reviewed the LRA and the TLAA documentations, including the program basis document, “CNS License Renewal Report.” Through TLAA and exemption evaluation results and in discussions with CNS personnel, the staff noted that certain CNS items involving calculations or analyses needed to be reviewed and determined whether or not they should be TLAAs. The staff’s initial review of the items below indicated that additional TLAAs may be needed. The staff issued a request for additional information (RAI) (RAI 4.1-2, July 14, 2009) from the applicant to enable the staff to evaluate whether the items in the following references should be TLAAs. The staff also asked the applicant to provide justification for any item that it determined not to be a TLAA:

- LRA Appendix C, “Response to BWRVIP [Boiling Water Reactor Vessel and Internals Program] Applicant Action Items,” in particular BWRVIP 25 (4) regarding susceptibility of the rim hold down bolts to stress relaxation

- CNS RPT 0 LRD03, Revision 1, Attachment 4, “USAR Results,” in particular:

- Section IV 6.3 Description (isolation valve)
- Section VI 4.1.1 High Pressure Coolant Injection (HPCI) System Components
- Section A 3.1.2 Corrosion and Erosion

The applicant responded to the RAI in a letter dated August 13, 2009, stating that it had reevaluated the items noted in the RAI, and found no items requiring a TLAA. The applicant, in its RAI response, stated that it had reviewed the applicant action items for the BWRVIP reports approved for license renewal, and re-reviewed its responses to these action items given in Appendix C to the LRA, and had not identified a need for any changes. The applicant stated that the analysis of stress relaxation for core plate rim hold-down bolts is not a TLAA because the existing analysis is not a 40-year analysis and only covers operation through 2010. The applicant stated that it must complete a new analysis prior to 2011 that will cover operation through the period of extended operation. The staff evaluated the response and agrees that the hold down bolts is not a TLAA because the existing analysis is for a design life of less than 40 years. Therefore the hold down bolts analysis is not a TLAA because it does not meet criterion (3) of 10 CFR 54.3 in that it did not involve time-limited assumptions defined by the current operating term (40 years).

In its response to the RAI regarding USAR Section IV-6.3 MSIVs, the applicant stated that the USAR statement is not a TLAA, as there is no analysis or calculation supporting the design cycles of the MSIVs. The applicant provided information on the original design objective for the MSIVs and projections that the 273 cycles per valve through the period of extended operation was far below the 2050 design cycles for the valves. The staff evaluated the response and finds it acceptable since the design cycles are design parameters which are not applicable to aging effects. Therefore the hold down bolts analysis is not a TLAA because it does not meet criterion (2) of 10 CFR 54.3 considering the effects of aging.

In its response regarding the HPCI system components, the applicant stated that the pipe stress calculations for the design of ASME III Code Class 2 and 3 piping systems and the HPCI piping analysis remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i). The applicant identified no non-class 1 components, other than piping system components, built to codes requiring a fatigue analysis. The staff evaluated the response and finds it acceptable since the HPCI system components, other than piping, were designed for number of cycles which are design parameters which are not applicable to aging effects. Therefore the HPCI system components, other than piping, are not TLAAs because they do not meet criterion (2) of 10 CFR 54.3 considering the effects of aging.

In its response to the RAI regarding corrosion allowances, the applicant stated that while USAR Table C-3-7 lists many corrosion allowances for CNS components, there are no analyses based on time-limited assumptions. The applicant also stated that loss of material is an aging effect requiring management that is addressed in AMRs for each system, managed by several AMPs, and is managed consistent with the guidance provided in the GALL Report. The staff evaluated the response and finds it acceptable because it does not meet criterion (3) of 10 CFR 54.3 in that it did not involve time-limited assumptions defined by the current operating term (40 years).

Based on its review, the staff finds the applicant’s response to RAI 4.1-2 acceptable. The staff’s concerns described in RAI 4.1-2 are resolved.

As required by 10 CFR 54.21(c)(2), the applicant must list all exemptions granted in accordance with 10 CFR 50.12, which are based on TLAAs, to be evaluated and justified for the purpose of continuation through the period of extended operation. The LRA indicates that exemptions for CNS were identified through a review of the USAR, fire protection documents, the operating license, the technical specifications, and docketed correspondence. The applicant determined that there are no exemptions remaining in effect for CNS that are based on TLAA. The staff reviewed selected documentation regarding the TLAA and exemption processes, including the applicant's response to RAI, and identified no cases where an exemption had been granted on the basis of a TLAA that should be justified for continuation through the period of extended operation.

4.1.3 Conclusion

On the basis of its review and the applicant's response to the staff's RAIs, the staff concluded that the applicant provided an acceptable list of TLAAs as required by 10 CFR 54.21(c)(1) and C(2). In addition, the staff concluded that no exemptions were granted on the basis of a TLAA pursuant to 10 CFR 50.12, and therefore, the requirement under 10 CFR 54.21(c)(2) does not apply.

4.2 Reactor Vessel Neutron Embrittlement

4.2.1 Neutron Fluence

4.2.1.1 *Summary of Technical Information in the Application*

In its LRA, the applicant has identified reactor vessel neutron embrittlement as a category of applicable TLAAs. The neutron embrittlement analyses are supported by unit-specific fluence calculations, which are discussed in Section 4.2.1 of the LRA, and the applicant stated that the calculations are performed to be consistent with the guidance contained in Regulatory Guide 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence" (RG 1.190, Reference 3).

4.2.1.2 *Staff Evaluation*

This evaluation pertains to Section 4.2 of the LRA submittal (and associated USAR Supplement, LRA Appendix A.1.2.1.1) and the acceptability of the proposed value of the pressure vessel fluence for 60 calendar years of operation.

By considering the applicable general design criteria (GDC), the NRC staff establishes whether or not the neutron fluence calculation adequately supports the reactor vessel neutron embrittlement analyses, such that compliance with 10 CFR 54.21(c)(1) can be determined. RG 1.190 describes methods and assumptions acceptable to the NRC staff for determining the pressure vessel neutron fluence with respect to the General Design Criteria (GDC) contained in Appendix A to 10 CFR 50. The staff's evaluation establishes that the applicant's neutron fluence calculations, which provide input to the neutron embrittlement-related TLAAs (e.g., SER Section 4.2.2), remain valid for the period of extended operation, thus demonstrating compliance with 10 CFR 54.21(c)(1)(i) as it pertains to the reactor vessel fluence calculation. In consideration of the guidance set forth in RG 1.190, GDC 14, 30, and 31 are applicable. GDC 14, "Reactor Coolant Pressure Boundary," requires the design, fabrication, erection, and testing of the reactor coolant pressure boundary so as to have an extremely low probability of abnormal leakage, rapidly propagating failure, and gross rupture. GDC 30, "Quality of Reactor Coolant Pressure Boundary," requires, among other things, that components comprising the reactor coolant pressure boundary be designed, fabricated, erected, and tested to the highest quality standards practical. GDC 31, “Fracture Prevention of Reactor Coolant Pressure Boundary,” pertains to the design of the reactor coolant pressure boundary stating:

> The reactor coolant pressure boundary shall be designed with sufficient margin to assure that when stressed under operating, maintenance, testing, and postulated accident conditions, (1) the boundary behaves in a nonbrittle manner and (2) the probability of rapidly propagating fracture is minimized. The design shall reflect consideration of service temperatures and other conditions of the boundary material under operating maintenance, testing, and postulated accident conditions and the uncertainties in determining (1) material properties, (2) the effects of irradiation on material properties, (3) residual, steady state and transient stresses, and (4) size of flaws.

The 60 year fluence values were calculated using the Radiation Analysis Modeling Application (RAMA) methodology, which was approved for use at CNS by the NRC staff in a safety evaluation accompanying a license amendment dated April 27, 2006. For CNS, the applicant estimated that the end-of-extended-license (license renewal) irradiation in effective full power years (EFPY) would be bounded by the 54 EFPY for which the analysis was performed. The NRC staff finds the enveloping nature of a 54 EFPY calculation acceptably conservative because the applicant also stated that, even at a 100-percent capacity factor, the plant would not accrue more than 50 EFPY of exposure through the period of extended operation. NUREG-1801, “GALL Report,” Volume 2, “Tabulation of Results,” Revision 1 indicates that ferritic materials for reactor pressure vessel beltline shells, welds, and assembly components must be evaluated for neutron irradiation embrittlement if high energy neutron fluence is greater than a threshold value of 1.0E+17 n/cm^2. Table 4.2-1 of Reference 1 identifies those components that have peak fluence values above 1.0E+17 n/cm^2. The staff finds that the peak values identified in Table 4.2-1 are acceptable due to the conservative nature of the 54 EFPY calculation and the calculational method’s adherence to the guidance contained in RG 1.190.

4.2.1.3 *USAR Supplement – documented in SER Section 4.2.1.2*

4.2.1.4 *Conclusion*

The staff reviewed the information submitted by the applicant regarding end-of-extended-life fluence calculations. The staff finds that the calculations were carried out using staff-approved methodologies and accounted for projected core operating conditions. In addition, the calculation is conservative because the applicant-predicted end-of-license irradiation is expected to be fewer EFPY than the 54 that was calculated.

4.2.2 Adjusted Reference Temperature Analysis

4.2.2.1 *Summary of Technical Information in the Application*

LRA Section 4.2.2 summarizes the evaluation of the adjusted reference temperature (ART) for the period of extended operation. A key parameter that characterizes the fracture toughness of a material is the reference nil-ductility transition temperature (RT_{NDT}) determined in accordance with the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section III, paragraph NB-2331, which increases as its exposure to neutron radiation increases. The effects of neutron radiation on RT_{NDT} are reflected in the reference temperature change (ΔRT_{NDT}). The ART is calculated by adding ΔRT_{NDT} to initial RT_{NDT} with an appropriate margin for uncertainties.

The ΔRT_{NDT} values for the CNS vessel beltline plates and welds were projected to 54 EFPY using the methods described in Regulatory Guide (RG) 1.99, Revision 2 so that the ART values could be revised to reflect the neutron exposure expected for the period of extended operation. The applicant reviewed data from the Reactor Vessel Integrity Database (RVID) and the reactor pressure vessel (RPV) surveillance data and used the highest limiting material property values in computations of ΔRT_{NDT} and ART for conservative results. The results are shown in LRA Table 4.2-2, meeting the TLAA for ART in accordance with 10 CFR 54.21(c)(1)(ii).

The applicant further notes that all of the projected ART values are below the 200 ^{o}F value that is suggested in Section 3 of RG 1.99 Revision 2 as an acceptable value of ART for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii).

4.2.2.2 *Staff Evaluation*

The staff reviewed LRA Section 4.2.2 to verify, in accordance with 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation. The applicant calculated the ΔRT_{NDT} and ART values based on the 54 EFPY fluences for the CNS RPV beltline materials shown in LRA Table 4.2-1. The staff performed independent (scoping) calculations for comparison to those from the applicant, as described in LRA Table 4.2-2. In each case, the applicant reports the same or a more conservative ΔRT_{NDT} value than that found in the staff's calculations, and all of the ART values are developed in accordance with RGs.

LRA Section 4.2.2 further notes that the ART values are well below the 200 ^{o}F suggested in Section 3 of RG 1.99, Revision 2, for the ART value at the end of life for new plants. This has no direct bearing on the staff's decision because there are no criteria, in accordance with 10 CFR Part 50, for accepting RPV ART values. The significance of ART values is evaluated indirectly in another TLAA, in LRA Section 4.2.3, "Pressure-Temperature (P-T) Limits."

4.2.2.3 *USAR Supplement*

The applicant provided an USAR summary description of its TLAA evaluation of the ART in LRA Section A.1.2.1.2. On the basis of its review of the revised updated safety analysis report (USAR) supplement, the staff finds that the summary description of the applicant's actions to address the ART is adequate.

4.2.2.4 *Conclusion*

On the basis of its review, the staff concludes that the applicant has demonstrated that the ART analyses have been projected to the end of the period of extended operation in a manner consistent with 10 CFR 54.21(c)(1)(ii). The staff also concludes that the USAR supplement contains an appropriate summary description of the TLAA evaluation as required by 10 CFR 54.21(d) and therefore, is acceptable.

4.2.3 Pressure-Temperature Limits

4.2.3.1 *Summary of Technical Information in the Application*

LRA Section 4.2.3 summarizes the evaluation of pressure-temperature (P-T) limits for the period of extended operation. The technical specifications contain P-T curves that are valid through 28 EFPY including the effect of the measurement uncertainty recapture power uprate. Revised P-T curves are not required at this time but will continue to be updated in accordance with 10 CFR 50 Appendix G, assuring that operational limits are valid through the period of extended operation (this is consistent with SRP-LR 4.2.2.1.3.3).

4.2.3.2 *Staff Evaluation*

The staff reviewed LRA Section 4.2.3 to verify that the applicant's analyses for the P-T curves have been developed in accordance with 10 CFR 50, Appendix G. In addition, the staff verified that the applicant's analyses for P-T curves would be effectively managed for the extended period of operation in accordance with 10 CFR 54.21(c)(1)(iii).

The current P-T limits, for operation up to 28 EFPY, were approved by the staff on March 26, 2008. LRA Section 4.2.3 indicates that revised P-T curves are not required at this time but will be updated as needed to assure that operational limits remain valid through the period of extended operation.

The staff does not require that the applicant submit P-T limit curves that are valid for the period of extended operation as part of the LRA for this TLAA; the applicant should implement changes to the P-T limit curves through license amendments to revise the plant technical specifications. Therefore, the staff finds that the applicant's plan to manage the P-T limits in accordance with 10 CFR 54.21(c)(1)(iii) is acceptable, and thus, it is also in accordance with 10 CFR 50.60 and 10 CFR Part 50, Appendix G.

4.2.3.3 *USAR Supplement*

The applicant provided a USAR supplement summary description of its TLAA evaluation of P-T limits in LRA Section A.1.2.1. 3. On the basis of its review of the revised USAR supplement, the staff finds the summary description of the applicant's actions to address P-T limits is acceptable.

4.2.3.4 *Conclusion*

The staff concludes on the basis of its review, that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(iii), that for P-T limits, the effects of aging on the intended function will be adequately managed such that P-T limits will be maintained through the period of extended operation in accordance with 10 CFR 50.60 and 10 CFR Part 50, Appendix G. The staff also concludes that the USAR contains an appropriate summary description of the TLAA evaluation in accordance with 10 CFR 54.21(d) and therefore, is acceptable.

4.2.4 Upper Shelf Energy Evaluation

4.2.4.1 *Summary of Technical Information in the Application*

LRA Section 4.2.4 presents the applicant's evaluation of Charpy upper-shelf energy (USE) values for the period of extended operation. As stated in 10 CFR Part 50, Appendix G, USE values for RPV materials must include the effects of neutron radiation and that Charpy USE at the one quarter thickness of the RPV wall (¼ T) location for the beltline materials including plates and welds must be maintained at no less than 50 ft-lb for the life of the RPV. Calculated neutron fluence values considering the extended operation to 54 EFPY (LRA Table 4.2-1) are used to project changes in USE values for the period of extended operation in accordance with 10 CFR Part 50, Appendix G.

The chemistry for each beltline region material and surveillance data (including the un-irradiated Charpy USE[1]) are from the RVID database and clarified in GE-NE-523-159-1292, "Cooper Nuclear Station Vessel Surveillance Materials Testing and Fracture Toughness Analysis" and BWRVIP-135, "BWR Vessel and Internals Project Integrated Surveillance Program (ISP) Data Source Book and Plant Evaluations." The projected Charpy USE values at the end of 54 EFPY for the RPV beltline plates and welds for CNS were determined in accordance with RG 1.99, Revision 2. Regulatory Position 1.2 is used when there is no surveillance data, and Position 2.2 is used when there are at least two credible data points from the surveillance capsule program. As seen in LRA Table 4.2-5, all plates and welds meet the 50 ft-lb criterion at 54 EFPY.

The RVID database shows that an equivalent margin analysis (EMA) was previously done on the welds to demonstrate that the welds were in compliance with Appendix G of 10 CFR Part 50 for the period of the original license. However, the updated RG 1.99, Revision 2 analysis for 54 EFPY demonstrates that the Charpy USE for all of the welds will remain at or above the 50 ft-lb threshold so that no EMA is required. Nevertheless, the applicant has updated the EMA calculations for 54 EFPY on the lower-intermediate circumferential weld (heat #1-240) and the lower axial welds (heat #2-233-1,-B,-C). The EMA results are shown in LRA Tables 4.2-3 and 4.2-4, and in all cases, the USE reductions for the CNS welds are less than the limiting reduction in BWRVIP-74-A, "BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines," and are consistent with the results shown in LRA Table 4.2-5 for analysis by RG 1.99, Revision 2, demonstrating the acceptability of the welds for service up to 54 EFPY.

4.2.4.2 *Staff Evaluation*

The staff reviewed LRA Section 4.2.4 to verify that, in accordance with 10 CFR 54.21(c)(1)(ii), the Charpy USE values have been projected to the end of the period of extended operation. According to RG 1.99, Revision 2, the predicted decrease in USE values due to neutron irradiation during plant operation is dependent upon the amount of copper in the material and the predicted neutron fluence for the material. RG 1.99, Revision 2 includes two different methods for calculating the predicted decrease in USE values:

- for materials that have less than two credible surveillance data, the RG recommends Position 1.2
- for those cases when there are at least two sets of credible surveillance data, the RG recommends Position 2.2

The CNS RPV lower intermediate shell heat G2802-2 has two credible surveillance data sets, so the applicant correctly used Position 2.2 to calculate the predicted USE decrease for this plate for the extended period of operation. For all of the other materials, there was no surveillance data and Position 1.2 was used.

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1 The welds for the RPV at CNS did not have a documented Charpy USE for the un-irradiated condition; the applicant used the highest reported Charpy V-notch (CVN) absorbed energy at +10 F (temperature) as a conservative estimate of the un-irradiated CVN USE. The plates had CVN USE data for the L-T orientation only. The USE for the L-T orientation was estimated to be 2/3 of the measured L-T value. This approach was initially proposed in the February 25, 1993 surveillance capsule test report GE-NE-523-159-1292.

For a conventional USE evaluation per RG 1.99, Revision 2, the un-irradiated Charpy USE value is needed to calculate the decrease in USE due to irradiation. The majority of the CNS RPV beltline materials fall into this category. For materials that do not have un-irradiated USE values, an EMA was performed using the methodology developed in the BWRVIP-74-A report.

The staff has performed independent (scoping) calculations and confirmed that the applicant's results are conservative, and in all cases the beltline materials for 54 EFPY will have a projected Charpy USE at or above 50 ft-lbs. Thus, the materials are in accordance with 10 CFR 50, Appendix G to the end of the period of extended operation.

The applicant prepared an EMA for the lower-intermediate circumferential weld (LRA Table 4.2-3) and for the lower axial welds (LRA Table 4.2.4) according to BWRVIP-74-A to demonstrate that the subject welds will provide margins of safety against fracture equivalent to those required by ASME Code Section XI, Appendix G. The EMA from BWRVIP-74-A utilized the technique originally developed in GE Topical Report NEDO-33205-A. In these cases, the applicant referenced BWRVIP-74-A to confirm that equivalent margins of safety against failure are maintained for its RPV beltline material by demonstrating that the percent USE decrease is less than the allowable USE decrease for the material established in BWRVIP-74-A. For CNS, the RPV beltline materials in LRA Table 4.2-5 all meet the 50 ft-lb criterion through the end of the period of extended operation, and the EMA evaluations in LRA Tables 4.2-3 and 4.2-4 meet the requirements in the BWRVIP-74-A report.

In RAI 4.2-3, dated June 29, 2009, the staff requested that the applicant confirm the fluence value used in LRA Table 4.2-3 for the lower-intermediate circumferential weld (1-240) after 54 EFPY. The value shown in LRA Table 4.2-3 for the subject weld does not agree with the value for the subject weld in LRA Tables 4.2-1 and 4.2-2. In its response dated July 29, 2009, the applicant indicated that the fluence value in LRA Table 4.2-3 is a typographical error. The fluence value for the subject weld should be the same in all three tables. Furthermore, the applicant confirms that the correct value of fluence was used in the RG 1.99, Revision 2 analysis reported in LRA Table 4.2-3 for the predicted decrease in the USE for the subject weld.

The staff confirms that the BWRVIP-74-A EMAs were appropriately applied and the percent USE decreases for the welds are less than the allowable USE decrease established in BWRVIP-74-A for RPV welds. Therefore, in accordance with 10 CFR 54.21(c)(1)(ii), the staff finds the CNS beltline materials USE requirement is in accordance with 10 CFR Part 50, Appendix G to the end of the period of extended operation.

4.2.4.3 *USAR Supplement*

The applicant provided an USAR supplement summary description of its TLAA evaluation of USE in LRA Section A.1.2.1.4. On the basis of its review, the staff finds the summary description of the applicant's actions to address USE is acceptable.

4.2.4.4 *Conclusion*

On the basis of its review, the staff concludes that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(ii), that all of the CNS RPV beltline materials will have Charpy USE at the ¼ T location of at least 50 ft-lb throughout the period of extended operation, 54 EFPY, in accordance with 10 CFR Part 50, Appendix G USE requirement to the end of the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of the TLAA evaluation in accordance with 10 CFR 54.21(d) and therefore, is acceptable.

4.2.5 Reactor Vessel Circumferential Weld Examination Relief

4.2.5.1 *Summary of Technical Information in the Application*

LRA Section 4.2.5 summarizes the evaluation of RPV circumferential weld inspection relief for the period of extended operation. The staff approved relief from circumferential vessel shell weld volumetric examinations for the fourth 10-year inservice inspection (ISI) interval by letter dated January 15, 2008. The submittal included an analysis showing that the CNS RPV parameters at 30 EFPY are comparable to the bounding parameters for the staff's analysis of the vessel built by Combustion Engineering, Inc. (CE) after 32 EFPY from the SER for BWRVIP-05, "BWR Vessel and Internals Project (BWRVIP), BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations." Additional analysis included here shows that the parameters for the CNS RPV projected to 54 EFPY are bounded by the staff's (64 EFPY) bounding CE parameters from the BWRVIP-05 SER. Therefore, the conditional probability of failure for the circumferential weld remains below that stated in the NRC's final safety evaluation (SE) for BWRVIP-05.

One of the basic assumptions used in the SE approving BWRVIP-05 is that the axial welds have a higher probability of failure than circumferential welds. The applicant has compared the CNS data for the limiting axial weld (2-233-B) to that used in the NRC limiting plant-specific case found in the SER for BWRVIP-05. The data demonstrate that the mean ART value (RT_{NDT} + ΔRT_{NDT} without the margin term) for the CNS axial weld is almost 40 ^{o}F less than the mean ART value for the NRC limiting plant-specific case. Therefore, the data for the limiting CNS axial weld is bounded by the NRC limiting plant-specific data from SER for BWRVIP-05. The procedures and training used to limit low temperature over-pressure events will be the same as those in use when CNS received approval by letter dated January 15, 2008, to use the BWRVIP-05 alternative for the current license term.

4.2.5.2 *Staff Evaluation*

The staff reviewed LRA Section 4.2.5 to verify, in accordance with 10 CFR 54.21(c)(1)(ii), that the analyses to support the relief from the ASME Code Section XI ISI of circumferential welds have been projected to the end of the period of extended operation. The technical basis for the relief is discussed in the BWRVIP-05 SER, in which the staff concludes that there are two criteria that the applicant must demonstrate in order to receive the requested relief: (1) the failure frequency for circumferential welds in BWR plants must be 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; therefore, the failure frequency for RPV circumferential welds is sufficiently low to justify elimination of ISI in accordance with the ASME Code Section XI and (2) the applicant must implement operator training and operating procedures that limit the frequency of cold overpressure events to the amount specified in the July 30, 1998, SE for the BWRVIP-05 report.

LRA Section 4.2.5 provides a comparison of the applicant's plant-specific information with the generic analysis information in the BWRVIP-05 SER to support its conclusion that the CNS RPV beltline circumferential weld parameters at 54 EFPY remain within the bounding parameters for CE RPVs at 64 EFPY from the BWRVIP-05 SER. Since the 54 EFPY mean ART value for CNS is less than the 64 EFPY value from the BWRVIP-05 SER, the staff concludes that the RPV conditional failure probability for CNS at 54 EFPY is bounded by the staff's generic analysis in the BWRVIP-05 SER. Therefore, the staff determines that the applicant's RPV circumferential welds satisfy the limiting conditional failure probability for circumferential welds at the end of the period of extended operation (the first criterion established in the BWRVIP-05 SER).

For the second criterion, the staff accepted the applicant's implementation of operator training and establishment of procedures, limiting the frequency of cold over-pressure events to the frequency specified in the BWRVIP-05 SER for the remaining initial licensed period of operation described in the letter dated January 15, 2008. The applicant stated in LRA Section 4.2.5 that CNS will use the same procedures and training during the period of extended operation in the same manner as has been practiced during the original period of operation. Based on this, the staff determines that continued implementation of operator training and establishment of procedures limiting the frequency of cold over-pressure events will be satisfied during the period of extended operation (the second criterion established in the BWRVIP-05 SER). Pursuant to SRP-LR 4.2.2.1.4, the staff determines that this condition concerns specific plant operation procedures and is not considered a TLAA.

In the BWRVIP-05 SER, the staff concludes that the failure probability of the RPV circumferential shell welds is substantially less than that of the RPV axial shell welds. In LRA Table 4.2-7, the applicant has summarized the effects of irradiation on the limiting axial weld at CNS and compared its properties to the NRC limiting plant-specific data used in the July 28, 1998, SER for BWRVIP-05. The higher copper content and chemistry factor for the CNS weld is offset by the CNS weld's lower initial RT_{NDT}. Consequently, the CNS axial welds are less susceptible to irradiation damage than the NRC limiting plant-specific case.

In addition, the staff compared the mean ART values of CNS weld data in LRA Tables 4.2-6 and 4.2-7. The mean ART for the axial welds at CNS is higher than the mean ART for the circumferential weld, indicating that the axial welds are more susceptible to radiation embrittlement than the circumferential welds. Therefore, the continuation of ISI for axial welds provides additional assurance that the structural integrity of the circumferential welds is adequate.

4.2.5.3 *USAR Supplement*

The applicant provided an USAR supplement summary description of its TLAA evaluation of RPV circumferential weld examination relief in LRA Section A.1.3.1. On the basis of its review of the USAR supplement, the staff finds the summary description of the applicant's actions to address RPV circumferential weld examination relief is acceptable.

4.2.5.4 *Conclusion*

On the basis of its review, the staff concludes that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(ii), that for RPV circumferential weld examination relief, the analyses have been projected to the end of the period of extended operation. The staff also concludes that the USAR contains an appropriate summary description of the TLAA evaluation in accordance with 10 CFR 54.21(d) and therefore, is acceptable.

4.2.6 Reactor Vessel Reflood Thermal Shock

The applicant, in its LRA, did not address this issue as a part of its TLAAs. Therefore, in RAI 4.2-1 dated July 16, 2009, the staff requested that the applicant perform an end-of-life thermal shock analysis on the RPV for a design-basis loss of coolant accident (LOCA) followed by a low-pressure coolant injection (LPCI). Since the effects of embrittlement assumed by this thermal shock analysis will change with an increase in the licensed operating period, in RAI 4.2-1, the staff requested that the applicant perform this analysis. The staff further requested that If this item does not require TLAA, the applicant should provide an explanation for not performing the analysis.

In a response letter dated August 17, 2009, the applicant stated that CNS has no CLB requirement to perform RPV post LOCA thermal shock analysis. To confirm the applicant's claim, the staff reviewed Section 3.0 of the applicant's current USAR and concludes that the applicant does not have any CLB requirement to perform RPV post LOCA thermal shock analysis, and that there is no regulatory requirement for the applicant to perform this analysis. RAI 4.2-1 is resolved.

4.2.7 Reflood Thermal Shock for the Reactor Pressure Vessel Core Shroud

The applicant, in its LRA, did not address this issue as a part of its TLAA analysis. Therefore, in RAI 4.2-2, dated July 16, 2009, the staff indicated that irradiation embrittlement may affect the ability of reactor vessel internals (RVIs), particularly the core shroud, to withstand a LPCI thermal shock transient. The analysis of core shroud strain due to reflood thermal shock during a LPCI thermal shock transient is based on the calculated neutron fluence at the end of the facility's licensed period. In RAI 4.2-2, the staff requested that the applicant performs this analysis, The staff further requested that If this item does not require a TLAA, the applicant should provide an explanation for not performing the analysis.

In a letter dated August 17, 2009, the applicant stated that CNS has no CLB requirement to perform RPV post LOCA thermal shock analysis for the RPV core shroud. Therefore, it did not include this analysis in its LRA. The staff reviewed Section 3.0 of the applicant's current USAR as a part of an independent verification for the thermal shock analysis of the RPV core shroud. Based on its review, the staff concludes that the applicant does not have any CLB requirement to perform post LOCA thermal shock analysis for the RPV core shroud and that there is no regulatory requirement for the applicant to perform this. RAI 4.2-2 is resolved.

4.3 Metal Fatigue

The staff notes that a metal component subjected to cyclic loading at loads less than the design load could fail due to fatigue. For CNS, metal fatigue of components has been evaluated based on the design transients and cycles for the current operating term. The validity of such metal fatigue analysis is reviewed for the period of extended operation. The applicant discussed the design codes used and the fatigue requirements of CNS components in Section 4.3 of the LRA. The staff reviewed the technical information in Section 4.3 of the LRA according to the guidance provided in SRP-LR Section 4.3.

The staff review identified several areas where it needed additional information to complete the review of Section 4.3 of the LRA. The staff transmitted RAIs to the applicant via a number of letters and the applicant responded to all RAIs issued.

In the third paragraph of LRA Section 4.3, the applicant stated, "If the component has a fatigue TLAA that remains valid (i) or is projected to cover the period of extended operation (ii), then cracking due to fatigue is not an aging effect requiring management for those components during the period of extended operation …" The staff noted that the applicant's statement, as quoted, may imply that cracking may be ignored if the stated conditions are met. Therefore, the staff issued RAI 4.3-1, by letter dated May 1, 2009, requesting the applicant to provide a basis or clarify the statement.

By letter dated June 15, 2009, the applicant responded to RAI 4.3-1 and stated that the statement quoted above is in accordance with 10 CFR 54.21(c) which indicates that an AMP is not required if a TLAA remains valid or is projected through the period of extended operation. The applicant stated that if new cracks are found during normal operation or surveillances, the condition is immediately documented in the Corrective Action Program and appropriate corrective actions are taken.

Based on its review, the staff found the applicant’s response acceptable because the applicant clarified that if flaws/cracks were discovered by inspections they would not be ignored and will immediately be documented and followed by appropriate corrective actions. Cracking is managed by separate aging management programs such as the In-service Inspection Program. The applicant clarified its position regarding TLAAs pursuant to 10 CFR 54.21(c), and the staff determined that the issue in RAI 4.3-1 is resolved.

In the paragraph immediately before the section title of LRA Section 4.3.1, the applicant further stated that “flaw indications discovered during inservice inspection are TLAA for those analyses based on time-limited assumptions defined by the current operating term…. A review of such flaw growth analyses for CNS has identified none that are TLAA.” The staff reads this statement to indicate that CNS may have discovered flaw indications. However, no details have been provided in the CNS LRA regarding the components where flaw indications were detected and the actions taken. With this concern, the staff issued RAI 4.3-2, in a letter dated May 1, 2009, requesting that the applicant:

(a) Clarify whether or not there were flaw indications during the ISI. If the indications were discovered during the pre-operational phase, describe what remedial or corrective actions have been taken.

(b) If flaw indications were discovered, provide a description of the flaws, the actions taken, the analysis method used, and disposition of the cases.

(c) Elaborate on the last part of the above quoted statement (i.e., “A review of such flaw growth analyses for CNS has identified none that are TLAA”).

By letter dated June 15, 2009, the applicant responded to RAI 4.3-2 (a), (b), (c) and indicated that the flaw indications referred to in part (a) of the RAI were found during ISI, not during pre-operational inspection. The applicant further stated that during the preparation of the LRA, it reviewed the plant ISI records and identified flaws that had been found and not repaired or replaced. In the RAI response, the applicant stated that flaw indications were detected in five components, as listed below:

(1) <u>FW Nozzle-to-Vessel Welds</u>. During 1991, ISI on the feedwater (FW) nozzles found indications in FW nozzle-to-vessel welds N4A, N4C, and N4D. Further evaluation under ASME Code Section XI was performed. NPPD submitted a fracture mechanics analysis for the nozzle forging to vessel weld using an RTNDT of 30 °F (Letter NLS9100849, G. R. Horn to U.S. NRC dated December 20, 1991, “Indications in FW Nozzle to Vessel Welds N4A, N4C, and N4D,” which includes GENE-523-133-1191, Revision 1 as an attachment). The calculated available fracture toughness remained well in excess of the required fracture toughness. The analysis did not consider FW thermal sleeve bypass

leakage and explains that was not necessary as recent ultrasonic testing (UT) revealed no evidence of thermal fatigue cracking.

GENE-523-133-1191 analyzed crack growth based on 120 startup cycles and 600 thermal/pressure cycles. At the time (1991), 120 startups were the allowable numbers for vessel transients. However, when the allowable vessel transients (USAR Table III.3-1) were increased to the current limits, the transient numbers used in GENE-523-133-1191 no longer bounded 40 years of operation.

Although the original analysis was done based on an assumed 40-year number of transients, the analysis is not being used to justify operation of the nozzle for the remainder of plant life. The nozzle continues to be inspected each 10-year ISI interval. As such, this analysis is not a TLAA.

(2) Main Steam Nozzle (N3A) to Vessel Weld. During the fall 1998 refueling outage (RFO-18), an indication was identified in the main steam (MS) nozzle-to-vessel weld N3A that exceeds the acceptance criteria of IWB-3512. This indication had been incorrectly identified in 1976 and 1986 as being in the nozzle forging. The 1998 examination identified that the indication was in the forging to vessel weld (this indication is similar to the FW nozzle indications). A fracture mechanics evaluation of this indication (GE-NE-B13-01980-24) was submitted to the NRC (Letter NLS980182, M. F. Peckham to U.S. NRC, "Main Steam Nozzle to Shell Weld Fracture Mechanics Evaluation," October 30, 1998).

Section 5.6 of GE-NE-B13-01980-24 calculates the flaw growth based on 120 startup/shutdown cycles. Although the original analysis was done based on an assumed 40-year number of transients, the analysis is not being used to justify operation of the nozzle for the remainder of plant life. The nozzle continues to be inspected each 10-year ISI interval. As such, this analysis is not a TLAA.

(3) Reactor Vessel Shell Indication. NPPD analyzed indications found in the reactor vessel shell during the 1998 RFO-18. That analysis states:

PIR 3-50914 (Condition Report CR98-0882) documented the condition that ultrasonic testing (UT) of the Reactor Pressure Vessel (RPV) welds VLA-BA-3 and BLC-BB-2 indicated that some flaws exceeded the IWB-3500 flaw allowable size requirements of the ASME Code Section XI. The purpose of this evaluation is to evaluate the unacceptable flaws in the welds to the requirements of IWB-3600 of the ASME Code Section XI and to provide closure to the PIR. The unacceptable indications documented in GE's data report are in two welds (RPV-03 and RPV-10).

There were a total of 62 indications in these two welds. The indications were close to mid-plane and appeared to be fabrication related. The indications were evaluated against IWB-3500; a few failed and were therefore evaluated against IWB-3600. These evaluations included various time frames (the 40-year license term of the plant, 16 EFPY, etc.), but were not used to justify the vessel for the remaining time in the 40-year license term. They were used to justify the vessel until the next inspection and thus were not TLAAs.

After supplemental UT, the sizes of the flaws were found to be within the limits of IWB-3500. A flaw evaluation per IWB-3600 was not performed; thus, there is no TLAA associated with these indications.

(4) Core Spray Piping Indications. Indications were found at core spray (CS) piping welds P1, P8a, P8b, and P9. These inspections were performed per BWRVIP guidelines and are not ASME Code pressure boundary welds. The analysis determined the acceptance criteria of BWRVIP-18 were met until the next inspection. The evaluation is not based on the life of the plant and therefore is not a TLAA.

An indication in a hidden weld in the CS piping internal to the vessel was also found and evaluated. This was not an ASME Code weld and so was not evaluated per that code. The indication was observed during a BWRVIP inspection of the CS piping inside the vessel. The evaluation determined the expected flaw growth by the subsequent inspection and showed that it is well below the allowable flaw size. The evaluation is not based on the life of the plant and therefore is not a TLAA.

(5) Core Shroud Indications. Indications in multiple shroud welds were observed in January 2005 and were re-inspected in November 2006. These were not ASME Code welds and so were not evaluated per that code. The welds were inspected based on BWRVIP guidelines and were evaluated according to BWRVIP-76, including plant-specific evaluations per BWRVIP-94. The evaluation showed the shroud to be acceptable without additional inspections for at least 10 years. The evaluation is not based on the initial 40-year operating term and therefore is not a TLAA.

Based on its review, the staff found the response to RAI 4.3 2 acceptable because the applicant provided the information requested and performed fracture evaluation for each of the components in accordance with either the ASME Code Section XI or EPRI BWRVIP guidelines to demonstrate that the affected components are able to tolerate the indicated flaws, until the next inspection. Although some of the evaluations were based on the 40-year life of the plant, these evaluations provided a basis to support a 10-year inspection frequency and these locations will be re-inspected in the next 10-year interval. The components continue to be examined through the ISI process or BWRVIP process, therefore the staff noted the related analyses are not identified as TLAAs and do not meet the definition of a TLAA pursuant to 10 CFR 54.3(a). Therefore, the staff determined that RAI 4.3 2 is resolved.

4.3.1 Class 1 Fatigue

LRA Section 4.3.1 describes the applicant's evaluation of TLAAs for Class 1 components and systems at CNS. The applicant indicated that the CNS Class 1 systems include components within the ASME Code Section XI, Subsection IWB inspection boundary.

In this section, the applicant indicated its reliance on the Fatigue Monitoring Program to track and evaluate the cycles of transients. The applicant also indicated that the CNS Fatigue Monitoring Program ensures that the numbers of transient cycles experienced by the plant remain within the allowable numbers of cycles, and hence the component cumulative usage factors (CUFs) would remain below the code allowable value of 1.0.

In this section of the LRA, the applicant states that normal startup and turbine roll transients are expected to exceed their analyzed value prior to the end of the period of extended operation. Specifically, normal startups project to reach the analyzed number of cycles for the feedwater (FW) piping, feedwater nozzles, main steam (MS) piping and core spray (CS) piping during the period of extended operation. However, LRA Section 4.3.1.1 states that the actual number of transient cycles remains within analyzed values used for reactor vessel fatigue analyses. The staff found that these statements contradicted each other and needed clarification.

Therefore, by letter dated July 14, 2009, the staff issued RAI 4.3.1-10 (this RAI was originally issued as RAI 4.3.1-1. This RAI was later revised as RAI 4.3.1-10, which superseded RAI 4.3.1-1), requesting the applicant to:

(a) Provide the basis that only the FW piping, FW nozzles, MS piping, and CS piping would exceed the analyzed number of cycles and other components would not.

(b) Correct the inconsistency between the statement which reads, "...that the actual numbers of transient cycles remain within analyzed values used for reactor vessel fatigue analyses," and LRA Table 4.3-1, which shows that the projected 60-year cycles for the startup and turbine roll transients exceed the analyzed cycles.

In its response to RAI 4.3-10(a), dated August 13, 2009, the applicant indicated that in USAR Table III-3-1, there are two analyzed values for each design cycle at CNS. The applicant stated that the first value (229 cycles) given in USAR Table III-3-1 are the number of cycles analyzed for the FW nozzles, RPV internals, and Class 1N piping, while the parenthetical value (400 cycles) are the number of cycles analyzed for other parts of the reactor vessel, as indicated in the footnote to USAR Table III-3-1. The applicant further indicated that for normal startup, the analyzed value for the FW piping, FW nozzles, MS piping, and CS piping is 229 cycles, while the analyzed value for the rest of the reactor vessel is 400 cycles. The applicant stated that according to LRA Table 4.3-1, the projected number of startups for 60 years at CNS is 245, which exceeds the 229 cycles analyzed for the FW nozzle and piping, but it does not exceed the 400 cycles analyzed for the other parts of the reactor vessel, except for the FW nozzles, RPV internals, and Class 1N piping.

Based on its review, the staff found the applicant's response reasonable because the applicant explained why only the indicated components would exceed the analyzed number of cycles and other components would not. The staff verified USAR Table III-3-1 and confirmed the applicant's explanation. Therefore, the staff determined that RAI 4.3.1-10(a) is resolved.

In its response to RAI 4.3-10(b), dated August 13, 2009, the applicant explained the inconsistency by stating that NPPD separated the fatigue discussion in the LRA into Section 4.3.1.1 for the reactor vessel excluding the FW nozzles and Section 4.3.1.2 for the FW nozzles. The statement at the end of LRA Section 4.3.1.1 was intended to apply only to those parts of the vessel discussed in 4.3.1.1 and not to the FW nozzle discussed in 4.3.1.2. The applicant stated that the portions of the reactor vessel discussed in LRA Section 4.3.1.1 are analyzed to 400 startups/shutdowns cycles and that value is not projected to be exceeded in 60 years. In concluding, the applicant stated that the last paragraph of LRA Section 4.3.1.1 was revised to clarify the discussion (Please see Section 4.3.1.1).

Based on its review, the staff found the applicant's response reasonable because the applicant explained and corrected the inconsistency. Therefore, the staff determined that RAI 4.3.1-10(b) is resolved.

4.3.1.1 *Reactor Vessel*

4.3.1.1.1 Summary of Technical Information in the Application

LRA Section 4.3.1.1 describes the CNS evaluation of fatigue TLAAs for the reactor vessel. The applicant stated that the CNS vessel is designed, fabricated, inspected, and tested in accordance with the ASME Boiler and Pressure Vessel Codes, Section III (1965 Edition and

January 1966 Addenda) and the original fatigue evaluations were performed by CE. The applicant presented the CUF values of record for the reactor pressure vessel Class 1 components in LRA Table 4.3-2.

The applicant stated that in 2007 General Electric reevaluated the fatigue usage for the reactor vessel to include the effects of the measurement uncertainty recapture (MUR) power uprate in the spring of 2008. The applicant also stated that the results of these analyses have been submitted to the NRC as part of the MUR request. The applicant further stated that fatigue analyses for several locations were performed using modern techniques that resulted in significantly lower CUF values, with the aid of removing some conservatism.

The applicant further indicated that the CNS Fatigue Monitoring Program will manage the effects of aging due to fatigue on the reactor vessel, in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.1.1.2 Staff Evaluation

The staff reviewed LRA Section 4.3.1.1 to verify, in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation.

In its review, the staff identified several areas that require clarification and explanation. LRA Table 4.3-1 contained a transient description, “turbine roll (assumed same as startup)” for which the basis of the assumption was not clear to the staff. The staff issued RAI 4.3.1-2, in a letter dated May 1, 2009, requesting the applicant to provide the basis for the assumption that the cycles of the turbine roll transient are the same as that of the startup transient and to describe the relationship between the turbine roll and startup transients.

In its response to RAI 4.3.1-2, dated June 15, 2009, the applicant stated that due to the relationship between the two, the number of occurrences for the turbine roll transient is assumed to be the same as the number of occurrences counted for the startup transient. The applicant stated that startup takes the plant from ambient conditions to 546 °F and turbine roll occurs after startup and continues until the plant reaches 100 percent power. Turbine roll is the warmup and loading of the main turbine, which occurs at the end of the startup transient.

Based on its review, the staff found the applicant’s response acceptable because the applicant has explained the validity of the assumption and has described the relationship between the turbine roll and startup transients. Therefore, the concern identified in RAI 4.3.1-2 is resolved.

LRA Table 4.3-1 provides the transient types and their respective cycles and 60-year projected number of cycles, based on which fatigue evaluations were made. However, the LRA does not correlate LRA Table 4.3-1 to the proper section of the USAR of CNS. While USAR Table III-3-1 provides the names and cycles of reactor vessel thermal transients, the description of the transients and their associated cycles is not quite consistent with the transient names and the cycles shown in LRA Table 4.3-1. The staff issued RAI 4.3.1-3, by letter dated May 1, 2009, requesting the applicant to clarify whether turbine roll, hot standby (FW cycling), pipe rupture and blowdown, operating basis earthquake (OBE), safety/relief valve actuations, and core spray injection transients (none of these were listed in USAR Table III-3-1) were considered in the original stress and fatigue analyses.

In its response dated June 15, 2009, the applicant stated that the major transients analyzed for the reactor vessel were listed in USAR Table III-3-1, and Technical Specification 5.5.5 requires counting of these reactor vessel transient cycles. The applicant stated that because these design cycles represent the significant thermal transients (normal and upset) foreseen for the reactor vessel, analysis of these transients satisfied the ASME B&PV Codes, Section III fatigue requirements for the reactor vessel. The applicant continued that fatigue analyses of other components considered the transients that the designers foresaw for those components. For some components other than the reactor vessel, additional transients not listed In the USAR are also counted by this program.

Below is the applicant's explanation of cycle counting for the transients identified by the staff via this RAI that are not listed in USAR Table III-3-1:

> Turbine roll - One turbine roll is assumed following every startup. Therefore, a specific listing for turbine roll in USAR Table III-3-1 was not provided to assure validity of the vessel fatigue analysis.
>
> Hot standby (FW cycling) constitutes two additional temperature excursions due to on/off cycles of FW for each shutdown. This was assumed concurrent with each shutdown so a specific listing of this transient was not provided in USAR Table III-3-1.
>
> Pipe rupture (loss-of-coolant accident (LOCA)) is a faulted condition, not a normal or upset condition, and hence, need not be included in an ASME fatigue analysis of Class I components. Operating Basis Earthquake was included in the fatigue calculations but was not tracked in the Fatigue Monitoring Program since it is not an operational transient as defined in the CNS USAR.
>
> Safety/relief valve actuations are not a factor in the reactor vessel fatigue analyses, but are a factor in the containment fatigue analyses. CNS includes them in the cycle counting procedure.
>
> Core spray injections - One cycle of core spray injection was included in the original analysis of the core spray nozzle. There have been no injections of core spray with the vessel at operating conditions. CNS is including one cycle in the environmentally assisted fatigue analyses for license renewal.

Based on its review, the staff found the applicant's response acceptable because the applicant stated that the appropriate transients were considered in the fatigue calculations of record (in USAR) and the applicant dispositioned its TLAA in accordance with 10 CFR 54.21(c)(1)(iii), such that the effects of aging will be managed by the applicant's Fatigue Monitoring Program. Therefore, the concern identified in RAI 4.3.1-3 is resolved.

LRA Section 4.3.1.1 discusses the TLAA for the reactor vessel which indicates that the fatigue analysis involved the MUR power uprate during the spring of 2008. The LRA states that: "Results of these analyses have been submitted to the NRC as part of the MUR request." Fatigue analyses for several locations were done using modern techniques and removing some conservatism that resulted in significantly lower CUFs. However, the LRA does not provide sufficient details (e.g., modern techniques or the conservatism) to enable the staff's review.

Therefore, the staff issued RAI 4.3.1-4, in letter dated May 1, 2009, requesting the applicant to:

(a) Describe the modern techniques used for these analyses.

(b) Describe the conservatism that was removed in the new analyses and show the differences between the new and old analysis results.

In its response to RAI 4.3.1-4(a), dated June 15, 2009, the applicant indicated that the evaluation for all locations used finite element analyses performed in accordance with the 1998 Edition, 2000 addenda of the ASME Code. The applicant indicated that this involved applying a Young's Modulus correction factor to the calculated stresses, applying an elastic plastic correction factor (K_e) where appropriate, and utilizing the 2000 addenda fatigue curve.

In its response to RAI 4.3.1-4(b), dated June 15, 2009, the applicant provided the "previous" CUF of record and the revised MUR CUF for reanalyzed components. The applicant indicated that the MUR analyses were previously submitted to the NRC in a letter from the applicant, "License Amendment Request to Revise Technical Specifications—Appendix K Measurement Uncertainty Recapture Power Uprate," dated November 19, 2007. The applicant also stated that this analysis was accepted by the NRC in License Amendment 231, dated June 30, 2008.

The applicant indicated that the removed conservatism that resulted in reduction to some CUF values was primarily the method of evaluating transients. The applicant indicated that earlier analyses added the numbers of all transients and evaluated them all as the most severe transient. The applicant also indicated that ungrouping the transients and separately evaluating the less severe transients led to significantly lower fatigue usage. The applicant further explained that additional conservatism was removed by changing from the assumed numbers of cycles in the original analyses to more realistic projected numbers of cycles based on actual plant operating history.

Based on its review, the staff found the applicant's response acceptable because the applicant clarified how it reanalyzed the stresses for these components; how conservatism was removed and that this analysis had been previously reviewed and accepted by the NRC in License Amendment 231, dated June 30, 2008. Therefore, the staff determined that RAI 4.3.1-4 is resolved.

As a result of RAI 4.3.1-10(b), discussed in the previous section, the applicant revised the last paragraph of LRA Section 4.3.1.1, as follows:

> The actual numbers of transient cycles remain within analyzed values used for reactor vessel fatigue analyses excluding the FW nozzles discussed in Section 4.3.1.2. CNS will monitor these transient cycles using the Fatigue Monitoring Program and take action if any of the actual cycles approach their analyzed numbers. As such, the Fatigue Monitoring Program will manage the effects of aging due to fatigue on the reactor vessel in accordance with 10 CFR 54.21(c)(1)(iii).

This revision is acceptable.

4.3.1.1.3 USAR Supplement

The applicant provided the USAR supplement summarizing the CNS TLAA evaluation of the reactor vessel in LRA Section A.1.2.2.1. Based on its review of the USAR supplement, the staff concludes that the applicant has provided an acceptable summary description of its actions to address the fatigue evaluation of the reactor vessel.

4.3.1.1.4 Conclusion

On the basis of its review, including the applicant's responses to the RAIs, the staff concludes that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of aging due to fatigue on the intended functions of the reactor vessel will be adequately managed during the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of the TLAA evaluation in accordance with 10 CFR 54.21(d).

4.3.1.2 *Reactor Vessel Feedwater Nozzle*

4.3.1.2.1 Summary of Technical Information in the Application

LRA Section 4.3.1.2 discusses the fatigue evaluations for the reactor vessel FW nozzle. The section is divided into two parts. The applicant used Part 1 to describe the fatigue evaluation history of the FW nozzle and used Part 2 to discuss the number of cycles used for the FW nozzle fatigue evaluation.

In Part 1, the applicant indicated that the FW nozzles were constructed as part of the reactor vessel by the original vessel supplier, CE, and the original stress report which was prepared by CE predicted that the FW nozzle CUF would be 0.715 after 40 years of operation.

The applicant stated that in response to BWR industry concerns over cracking of the FW nozzle blend radius due to rapid cycling, the CNS FW nozzles were modified in 1980. The reason for the modification was to remove the stainless steel cladding in order to reduce thermal stresses and crack initiation since the applicant believes that the cladding is more susceptible to cracking than the base metal. In addition, the applicant stated that removal of the cladding was followed by installation of concentric thermal sleeves to the FW nozzles. The applicant also stated that CNS FW nozzle fatigue has gone through multiple revisions due to the removal of cladding, installation of thermal sleeves, CNS pipe support qualification project, investigation of effects of FW nozzle rapid cycling, and effects of MUR power uprating. The applicant further stated that the projected CUF for the nozzle/shell junction slightly exceeds 1.0 and so fatigue of the FW nozzles will be managed by the Fatigue Monitoring Program during the period of extended operation.

In Part 2, the applicant discussed the FW cycles. Two transients are actually discussed and, these are the FW on/off cycles and the FW rapid cycling transients. The applicant stated that the FW rapid cycling was analyzed based on the data of years of operation, and the number of analyzed years (40) will be exceeded during the period of extended operation. Therefore, the applicant concluded that the FW nozzle CUF could not be successfully projected for the period of extended operation. The applicant also stated that CNS will continue to manage fatigue due to rapid cycling using the BWR Feedwater Nozzle Program. The applicant concluded that the effects of fatigue on the FW nozzles will be managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.1.2.2 Staff Evaluation

The staff reviewed LRA Section 4.3.1.2 to verify, in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation.

LRA Section 4.3.1.2.2 discusses FW nozzle cycles analyzed. It first discusses the FW on/off cycles, followed by a discussion of FW rapid cycling. In its review, the staff found that description of FW cycles is not clear, and the FW rapid cycling transient is not included in LRA Table 4.3-1. Therefore, the staff issued RAI 4.3.1-5 dated May 1, 2009, requesting the applicant to clarify the following points:

(a) Confirm the assumption that six FW on/off cycles are consumed for every shutdown operation is conservative.

(b) Explain why FW rapid cycling transient is not included in LRA Table 4.3-1.

(c) Describe the differences between the FW on/off cycles and the FW rapid cycling transients.

In its response to RAI 4.3.1-5(a), dated June 15, 2009, the applicant indicated that CNS indirectly accounts for the FW on/off cycles by counting the concurrent events of startup and shutdown. The applicant also indicated that there are no records of actual cycles logged since CNS does not monitor these transients.

The applicant indicated that during low power operations, FW flow is controlled by the FW startup flow control valves. The applicant also indicated that the FW startup flow control valves operate in an automatic mode so as to allow the FW system to maintain constant reactor vessel level with a small but stable FW flow. The applicant further indicated that this mode of operation minimizes the need to start and then stop FW flow to maintain levels, which is the transient that constitutes a FW on/off cycle. The applicant concluded that by using this method of operation, namely, using startup flow control valves to control reactor vessel level at low power levels, the assumption of six cycles per shutdown is conservative.

Based on its review, the staff found the applicant’s response reasonable because at CNS FW flow is controlled by the FW startup flow control valves, and the capability of automatic control mode leads to a minimal number of FW on/off cycle formations and that the applicant is managing the effects of aging with its BWR Feedwater Nozzle Program in accordance with 10 CFR 54.21(c)(1)(iii), through inspections of these components. Therefore, the concern identified in RAI 4.3.1-5(a) is resolved.

In its response to RAI 4.3.1-5(b), dated June 15, 2009, the applicant indicated that the effects of FW rapid cycling have been included in the fatigue analysis for the FW nozzle based on operating time in years of operation as stated in the LRA. However, the applicant indicated that it is not possible to count these cycles as discrete transients similar to the transients counted as listed in LRA Table 4.3-1. When reanalyzing the FW nozzle to account for the effects of the reactor water environment as part of the Fatigue Monitoring Program, the applicant stated that the rapid FW cycling transient will be considered acceptable for the additional 20 years.

Based on its review, the staff found the applicant’s response reasonable because the applicant explained that it is not possible to count FW rapid cycles as discrete transients similar to the transients counted as listed in LRA Table 4.3 1. However, the applicant stated that the FW rapid cycling transients were included in the fatigue analysis for the FW nozzle based on operating time in years of operation. The applicant stated that when it reanalyzes the FW nozzle to incorporate the environmental effects of reactor water as part of its Fatigue Monitoring Program, it will incorporate the effects of the rapid FW cycling transient. The applicant’s disposition of the TLAA for the FW nozzles is in accordance with 10 CFR 54.21(c)(1)(iii) during the period of extended operation. Therefore, the concern identified in RAI 4.3.1 5(b) is resolved.

In its response to RAI 4.3.1-5(c), dated June 15, 2009, the applicant indicated that in the GE stress report for the nozzle modifications, fatigue evaluation for planned operation thermal cycles was separated into on/off cycles and rapid (mixing) cycles. The applicant indicated that FW on/off cycling is starting and stopping FW flow to the reactor vessel associated with operation at low power and during startups and shutdowns; whereas, rapid cycling is caused by intermittent leakage around the thermal sleeve (a press fit) and results in alternating temperatures on the blend radius (as defined in ASME Code Section VIII – Rules of Construction for Pressure Vessels) of the FW nozzle to the vessel shell.

The applicant asserted that the fatigue TLAA for license renewal and the CLB fatigue analysis have the same basis. The applicant indicated that in the case of the FW nozzle, the CNS TLAA includes the effects of both on/off cycles and rapid cycling. The applicant further indicated that the result of the screening analysis shown in LRA Table 4.3-3 was an environmentally adjusted CUF greater than 1.0 indicating the need for a refined analysis that will be applied through the Fatigue Monitoring Program prior to the end of the period of extended operation. Therefore, managing the effects of aging due to fatigue is in accordance with 10 CFR 54.21(c)(1)(iii).

Furthermore, the applicant indicated that the major transients analyzed for the reactor vessel are listed in USAR Table III 3 7, and Technical Specification 5.5.5 requires the counting of reactor vessel design cycles.

Based on its review, the staff found the applicant's response reasonable because the applicant provided the information requested, described the differences between the FW on/off cycles and the FW rapid cycling transients and the applicant will be managing the effects of aging in accordance with 10 CFR 54.21(c)(1)(iii), by a refined analysis for the feedwater nozzle performed as part of its Fatigue Monitoring Program.

4.3.1.2.3 USAR Supplement

The applicant provided the USAR supplement summarizing the CNS TLAA evaluation of the FW nozzle in LRA Section A.1.2.2.1. Based on its review of the USAR supplement, the staff concludes that the applicant provided an acceptable summary description of its actions to address the FW nozzle fatigue evaluation.

4.3.1.2.4 Conclusion

On the basis of its review, including the applicant's responses to the RAIs, the staff concludes that the applicant has demonstrated that the effects of aging on the intended functions of the FW nozzle will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii). The staff also concludes that the USAR supplement contains an appropriate summary description of the TLAA evaluation in accordance with 10 CFR 54.21(d).

4.3.1.3 *Reactor Vessel Internals*

4.3.1.3.1 Summary of Technical Information in the Application

In LRA Section 4.3.1.3, the applicant indicated that the CNS reactor pressure vessel internals (RVIs) are not Class 1 reactor coolant pressure boundary (RCPB) components. Therefore, no plant-specific fatigue analysis of the entire RVIs was performed. The applicant further indicated that the only TLAAs associated with fatigue of the RVIs at CNS are the analyses for core plate plugs. The applicant also indicated that a qualitative review of the internals was performed for the MUR, concluding that the governing stresses for all RPV internal components in the MUR condition remain bounded by the existing CUF values.

For the core plate plugs, the applicant indicated that CNS has performed a stress analysis based on normal operating conditions, pressure and thermal transients, and plug installation-removal operations. The results show acceptable stress levels in all plug components. The applicant indicated, however, that the fatigue life of the core plate plug is only about 32 EFPY. The applicant further indicated that the BWR Vessel Internals Program will be used to manage cracking due to fatigue of the core plate plugs for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.1.3.2 Staff Evaluation

The staff reviewed LRA Section 4.3.1.3 to verify, in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation.

LRA Section 4.3.1.3 discusses TLAA for RVIs, and states, "A qualitative review of the internals was performed for the measurement uncertainty recapture, concluding that the governing stresses for all RPV internal[s] components in the MUR condition remain bounded by the existing values." The staff found it unclear how a qualitative review could produce creditable results to conclude that all RPV internals components in the MUR condition remain bounded by the existing values. Therefore, the staff issued RAI 4.3.1-6, in a letter dated May 1, 2009, requesting the following information:

(a) Provide the basis to justify that a qualitative review is sufficient to conclude that all RPV internal components in the MUR condition remain bounded by the existing values.

(b) LRA Table 4.3-2 contains the CUF results for the RVIs. However, only a single location in the RVI is reported, core plate plugs. Explain why only one single location is reported. Also explain whether this result is from the original stress and fatigue analyses, or the value is reflecting the qualitative review, and the value has accounted for the MUR condition.

In its response to RAI 4.3.1-6(a), dated June 15, 2009, the applicant indicated that CNS previously submitted the license amendment request for the MUR power uprate to the NRC for review. (NPPD Letter NLS2007069, Stewart B. Minahan to U.S. NRC Document Control Desk, "License Amendment Request to Revise Technical Specifications - Appendix K Measurement Uncertainty Recapture Power Uprate," November 19, 2007). The applicant indicated that this submittal included a qualitative review of the RVIs fatigue. The applicant also stated that a qualitative review was considered adequate because the RVIs are not ASME Code parts (non-pressure boundary parts). The applicant further indicated that the NRC approved the CNS MUR uprate via NRC letter, Carl F. Lyon to Stewart B Minahan, dated June 30, 2008.

Based on its review, the staff found the applicant's response reasonable because the applicant provided the information requested, asserting that the RVIs are non-pressure boundary parts, and the staff approved the applicant's qualitative review report. Therefore, the concern identified in RAI 4.3.1-6(a) is resolved.

In its response to RAI 4.3.1-6(b), dated June 15, 2009, the applicant stated that there is no original stress and fatigue analysis for the RVIs as discussed in response to part (a). The applicant stated that the CUF identified in LRA Table 4 3-2 (core plate plugs) was calculated as part of a modification that installed these plugs.

Based on its review, the staff found the applicant's response reasonable because there is no fatigue CLB for the RVIs and clarified that the CUF for the core plate plugs was calculated as part of modification that installed these plugs and that the applicant is managing the effects of aging with its BWR Vessel Internals Program in accordance with 10 CFR 54.21(c)(1)(iii), through periodic inspections. Therefore, the concern identified in RAI 4.3.1-6(b) is resolved.

LRA Table 4.3-2 shows the CUF for Class 1 components. Usually, all critical components within Class 1 pressure boundary must have usage evaluated. However, Note 2 beneath LRA Table 4.3-2 identified 12 components in the reactor vessel that were exempted from CUF calculation as per the guidance of Paragraph N-415.1 of the 1965 edition of Section III of the ASME Code. Therefore, the staff issued RAI 4.3.1-8, in a letter dated July 14, 2009, requesting the applicant to provide the basis that the targeted components could be exempted from fatigue evaluation.

In its response to RAI 4.3.1 8, dated August 13, 2009, the applicant stated that Section N 415.1 of the ASME Code states that an analysis for cyclic operation (i.e., a fatigue analysis) is not required for a vessel or part thereof that meets the six requirements of Section N 415.1. The applicant stated that the original reactor vessel stress report documents the review of each of the six criteria of N415.1 for each component and concluded that each component (Note 2 of LRA Table 4.3 2 identified 12 components) was exempt from detailed fatigue analyses. The applicant also stated that some of the N 415.1 criteria use the number of cycles anticipated for the vessel in the calculation. The applicant further stated that, since the limiting values utilized in the ASME Code are far beyond the actual cycles anticipated, they do not represent 40 year design numbers, and the report is thus not a TLAA. The staff noted a fatigue analysis exemption evaluates an envelope of material, temperature, pressure and mechanical load parameters (relative to the instrument piping design data) against the conditions stipulated in the ASME Code to demonstrate that analysis for cyclic operation is not required.

Based on its review, the staff found the applicant's response reasonable because these components of interest meet the six requirements of Section N 415.1 for exemption and since the total thermal cycles expected for 60 years is less than the cycles stipulated in the ASME Code for exemption, those components which were exempted from fatigue evaluation in the original design report remain exempted during the period of extended operation. Therefore, the concern identified in RAI 4.3.1 8 is resolved.

LRA Section 4.3.1.3 indicates that no plant-specific fatigue analysis of the entire RVIs was performed. In addition, in the same paragraph, the LRA indicates that the only TLAA associated with fatigue of the RVIs at CNS are those for the core plate plugs. The staff found such statements questionable because even being non-RCPB components, Class 1 components are subject to fatigue requirements. For older vintage plants, there may be cases where explicit fatigue usage evaluations are not required, and RVIs were implicitly designed for low cycle fatigue based upon the RCS design transient projections for 40 years. Therefore, the staff issued RAI 4.3.1-9, in letter dated July 14, 2009, requesting the applicant to provide the basis of justification for only identifying core plate plugs as requiring TLAAs.

Based on its review, the staff found the applicant's response acceptable because the applicant confirmed that its site is an older vintage plant, where the RVIs were not explicitly designed for fatigue based upon the RCS design transient projections for 40 years, except for the core plate plugs, which involved structural modification and augmented analysis. Therefore, the concern identified in RAI 4.3.1 9 is resolved.

The applicant further indicated that the core plate plugs were installed after initial construction as a modification, and that at the time of the modification, the designers opted to perform an analysis considering fatigue, embrittlement, and other factors to confirm the design. The applicant further explained that since this analysis is in accordance with the 10 CFR 54 definition for a TLAA, it is identified in the LRA as the only TLAA for the RVIs.

Based on its review, the staff found the applicant's response acceptable because the applicant confirmed that its site is not an older vintage plant, where the RVIs were not explicitly designed for fatigue based upon the RCS design transient projections for 40 years, except for the core plate plugs, which involved structural modification and augmented analysis. Therefore, the concern identified in RAI 4.3.1-9 is resolved.

The applicant's disposition of the core plate plugs to TLAA is appropriate. The staff noted that the applicant has existing aging programs in place to manage the aging issue for RVIs as described in LRA Section 3.1.2.1.2. The staff verified LRA Section 3.1.2.1.2 and found that CNS will use four programs to manage the aging effects for the RVI components, including BWR Vessel Internals, ISI, Thermal Aging and Neutron Irradiation Embrittlement of CASS, and Water Chemistry Control (BWR). On the basis of its review, the staff found that CNS has appropriately managed the aging for the RVI components.

4.3.1.3.3 USAR Supplement

The applicant provided the USAR supplement summarizing the CNS TLAA evaluation of RVIs in LRA Section A.1.2.2.1. Based on its review of the USAR supplement, the staff concludes the applicant provided an acceptable summary description of its actions to address the fatigue evaluation of the RVIs.

4.3.1.3.4 Conclusion

On the basis of its review, including the applicant's responses to the RAIs, the staff concludes that the applicant has demonstrated that the effects of aging on the intended function of the RVIs will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii). The staff also concludes that the USAR supplement contains an appropriate summary description of the TLAA evaluation, in accordance with 10 CFR 54.21(d).

4.3.1.4 ***Class 1 Piping***

4.3.1.4.1 Summary of Technical Information in the Application

In LRA Section 4.3.1.4, the applicant indicated that the original CNS piping was designed in accordance with the United States of America Standards (USAS) B31.1 design code and portions of the RCPB piping and nozzle safe ends that are susceptible to intergranular stress corrosion cracking (IGSCC) have been replaced with resistant material. The applicant indicated that the design code for the replaced RCPB piping is in the ASME Code Section III, 1983 Edition.

The applicant explained that for the B31.1 piping, because the transients experienced by the RCPB will not exceed 7,000 full temperature cycles in 60 years of operation, the existing stress analyses remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

The applicant indicated that CNS has performed fatigue analyses for reactor recirculation (RR), residual heat removal (RHR), reactor water cleanup, MS, CS, reactor FW, and vessel level sensing lines. The results are shown in LRA Table 4.3-2. The applicant further indicated that CNS will monitor the cycles actually incurred compared with the cycles analyzed using the Fatigue Monitoring Program and assure that corrective action is taken if any of the actual cycles approach their analyzed numbers. CNS will manage the effects of aging due to fatigue per the

ASME Code Section III piping using the Fatigue Monitoring Program in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.1.4.2 Staff Evaluation

The staff reviewed LRA Section 4.3.1.3 to verify that the TLAA remains valid during the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i), and to determine that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

For piping that is designed to B31.1 code, the fatigue requirement is implicitly built into the stress analysis. B31.1 code imposes reduction factors to reduce the thermal stress range allowable if full temperature range cycles exceed 7,000. According to LRA Table 4.3-1, the 60-year projected cycles are less than the 40-year design values. On this basis, the staff finds the applicant's claim that the TLAA for the B31.1 piping remains valid, in accordance with 10 CFR 54.21(c)(1)(i), during the period of extended operation acceptable.

For the ASME Code Section III piping, the applicant indicated that the effects of aging due to fatigue will be managed using the Fatigue Monitoring Program, in accordance with 10 CFR 54.21(c)(1)(iii). The staff finds this disposition acceptable because it is consistent with the GALL Report.

4.3.1.4.3 USAR Supplement

The applicant provided the USAR supplement summarizing the CNS TLAA evaluation of Class 1 piping in LRA Section A.1.2.2.1. Based on its review of the USAR supplement, the staff concludes the applicant provided an acceptable summary description of its actions to address the fatigue evaluation of the Class 1 piping.

4.3.1.4.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(i), that the analyses of Class 1 piping will remain valid during the period of extended operation. The staff also concludes that the applicant has demonstrated that the effects of aging on the intended function of the Class 1 piping will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii). The staff also concludes that the USAR supplement contains an appropriate summary description of the TLAA evaluation, in accordance with 10 CFR 54.21(d).

4.3.2 Non-Class 1 Fatigue

4.3.2.1 *Summary of Technical Information in the Application*

Section 4.3.2 of the LRA describes the CNS evaluation of non-Class 1 component fatigue analyses. The applicant indicated that CNS evaluated the plant operation records and determined that the total number of thermal cycles experienced by the non-Class 1 piping will be less than 7,000 for 60 years of plant operation. The applicant concluded that the pipe stress calculations for the non-Class 1 piping will remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

The applicant also indicated that CNS has no non-Class 1 components built to the ASME Code Section III, NC-3200 or the ASME Code Section VIII, Division 2 specifications; therefore, it has no associated TLAA for non-Class 1 components other than piping system components.

4.3.2.2 *Staff Evaluation*

The staff reviewed LRA Section 4.3.2 to verify, in accordance with 10 CFR 54.21(c)(1)(i), that the TLAA remains valid during the period of extended operation.

The applicant indicated that explicit fatigue analyses were not required for the evaluation of non-Class 1 components. Instead, the piping design code contained a limit of 7,000 for equivalent full range thermal cycles. The applicant also stated that all non-Class 1 components are projected to have less than 7,000 cycles for 60 years of plant operation.

According to LRA Table 4.3-1, the 60-year projected cycles are less than the 40-year design values. Therefore, the staff finds the applicant's claim that the TLAA for non-Class 1 piping remains valid during the period of extended operation acceptable.

4.3.2.3 *USAR Supplement*

The applicant provided the USAR supplement summarizing the CNS TLAA evaluation of non-Class 1 piping in LRA Section A.1.2.2.2. Based on its review of the USAR supplement, the staff concludes the applicant provided an acceptable summary description of its actions to address the fatigue evaluation of the non-Class 1 piping.

4.3.2.4 *Conclusion*

On the basis of its review, the staff concludes that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(i), that the analyses of non-Class 1 components will remain valid during the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of the TLAA evaluation, in accordance with 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*

Section 4.3.3 of the LRA describes the applicant's evaluation of the effects of the reactor coolant environment on the fatigue life of components. The applicant indicated that it evaluated locations identified in NUREG contractor report (NUREG/CR)-6260 that are applicable to CNS, as listed below:

- reactor vessel shell and lower head
- reactor vessel FW nozzle
- reactor recirculation piping (including inlet and outlet nozzles)
- CS line reactor vessel nozzles and associated Class 1 piping
- RHR return line Class 1 piping
- FW line Class 1 piping

The applicant further indicated that for evaluation purposes, three of these locations are subdivided further, resulting in a total of nine locations for fatigue evaluation considering the effects of reactor coolant environment as shown in LRA Table 4.3-3. Of the nine locations listed in LRA Table 4.3-3, three have environmentally adjusted CUFs greater than 1.0. The applicant indicated that these locations would be addressed by the CNS Fatigue Monitoring Program, in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.3.2 *Staff Evaluation*

The staff reviewed LRA Section 4.3.3 to verify, in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be acceptably managed for the period of extended operation.

The CNS Fatigue Monitoring Program tracks transients and cycles of RCS components that have explicit design transient cycles to assure that these components remain within their design-basis. Generic Safety Issue (GSI)-166, "Adequacy of the Fatigue Life of Metal Components," raised concerns regarding the conservatism of the fatigue curves used in the design of the RCS components. Although GSI-166 was resolved for the current 40-year design life of operating components, the staff identified in GSI-190, "Fatigue Evaluation of Metal Components for 60-year Plant Life," the need to address environmental effects on fatigue life for license renewal.

In response to GSI-190, the applicant stated in the license renewal Commitment (NLS2008071-08) that:

> Consideration of the effect of the reactor water environment will be accomplished through implementation of one or more of the following options for the FW nozzles, core spray nozzles, and RHR pipe transition[:]
>
> (1) Update the fatigue usage calculations using refined fatigue analyses to determine valid CUFs less than 1.0 when accounting for the effects of reactor water environment. This includes applying the appropriate [fatigue correction] F_{en} factors to valid CUFs determined using an NRC-approved version of the ASME code or NRC-approved alternative (e.g., NRC-approved code case).
>
> (2) Repair or replace the affected locations before exceeding a CUF of 1.0.

As indicated by the applicant, the use of an inspection program to manage fatigue will require prior staff review and approval. The CNS Fatigue Monitoring Program will require the applicant to monitor the fatigue usage of the LRA Table 4.3-3 locations and to take corrective actions if the CUF, including environmental effects at these locations, is projected to exceed the allowable value of 1.0 during the period of extended operation. The staff found that the CNS Fatigue Monitoring Program provides an acceptable program to manage the effects of the reactor coolant environment on the fatigue life of the RCPB components during the period of extended operation because it provides a means to address the very important aging mechanism and effects associated with the reactor coolant environment on the fatigue life of the components.

The staff reviewed the environmental fatigue CUFs in LRA Table 4.3-3 and found additional information is necessary to facilitate its evaluation. LRA Note 1 of LRA Table 4.3-3 indicates that the 60-year CUF values (without environmental effects adjustment) recalculated for license renewal reflect removal of conservatism without explanation. Therefore, the staff issued RAI 4.3.1-11, in a letter dated July 14, 2009, requesting the applicant to:

(a) Specify the elements that constitute the “conservatism,” and describe analysis methods used in the recalculation that helped CNS to achieve the goal for lowering the CUF value.

(b) Explain why “removing conservatism” could not bring down the 60-year CUF for the CS reactor vessel nozzle as expected. In fact, the recalculated value is now much greater than the 40-year design CUF.

(c) Provide the technical basis that supports the calculation of the environmental factor (F_{en}) for alloy 600.

In its response to RAI 4.3.1-11(a), dated August 13, 2009, the applicant indicated that as a result of CNS being evaluated for thermal power optimization (TPO), some of the governing usage factors for the RPV and piping were revised from those in the original stress reports. The applicant indicated that the results of those evaluations were used in the reactor water environmental fatigue assessment for CNS. The applicant also indicated that some “refinements” were made to the usage factor calculations during the TPO assessments, and further refinements were made during the reactor water environmental fatigue assessment.

The applicant explained that in some cases, the grouping of transients (i.e., evaluating all transients as the most severe transient) contributed to the conservatism of the analysis, and ungrouping the transients and separately evaluating the less severe transients led to significantly lower fatigue usage. The applicant indicated that this was the primary source of reducing conservatism in the TPO assessments. The applicant stated another method used to reduce conservatism was using logarithmic interpolation of the fatigue curve instead of approximating the allowable number of cycles by reading from the fatigue curve directly.

The applicant indicated that for the reactor water environmental fatigue assessment, the rules of the ASME Code, Section III, 2000 addenda, were used, which superseded the edition of the ASME Code originally applied in the calculations (for example, the CNS RPV was designed in accordance with the 1965 Edition with addenda through winter 1966 of the ASME Code). The applicant also indicated that the revised rules include a revised fatigue curve and use of Young's Modulus and K_e correction factors for determining alternating stress intensity, which were not in the rules in the original code of record. The applicant indicated that these methods are consistent with the approach described in the fatigue evaluations documented in NUREG/CR-6260, which forms the basis for the approach used for the CNS reactor water environmental fatigue assessment.

Based on its review, the staff found the applicant’s response reasonable because the applicant provided the information requested and described the sources of conservatism that were removed. Therefore, the concern identified in RAI 4.3.1-11(a) is resolved.

In its response to RAI 4.3.1-11(b), dated August 13, 2009, the applicant indicated that for the CS nozzle calculation, it applied a stress multiplier of 1.006 and a K_e factor. The applicant also indicated that the CUF was calculated based on the 60 year projected cycles. The 60 year projected numbers of cycles for startups and shutdowns is about a factor two greater than the values used in the previous analyses.

Based on its review, the staff found the applicant's response did not address the conservatism removed. Instead, it mentioned the stress multiplier and the K_e factor, which will magnify the CUF results. In addition, the applicant stated in its response that "the 60 year projected numbers of cycles for startups and shutdowns is about a factor two greater than the values used in the previous analyses." The staff required additional clarification on this issue. As can be seen in LRA Table 4.3-1, for the startup transient, the 60 year projected cycles is only slightly larger than the design cycles (245 vs. 229). For the cooldown transient, the 60 year projected cycles is slightly lower than the design cycles (225 vs. 229). On September 29, 2009, the staff held a teleconference call with the applicant, where the applicant stated that for some components, including the core spray reactor vessel nozzle, the current cycle limit should be referred to the values shown in the parentheses indicated in the note beneath USAR Table III-3-1, which is 400 cycles for normal startup and 398 cycles for normal cooldown. The staff verified USAR Table III-3-1 and found the applicant's explanation reasonable. With all things considered, the net effects make the 60 year CUF value of the core spray reactor vessel nozzle larger than the 40 year value. Therefore, RAI 4.3.1 11(b) is resolved.

In its response to RAI 4.3.1-11(c), dated August 13, 2009, the applicant indicated that the F_{en} for alloy 600 was calculated in accordance with the method described in NUREG/CR 6335, which includes specific information for alloy 600. However, the staff noted that NUREG/CR-6909 also provides equations for determining the F_{en} factor for nickel alloy components. The staff further noted that use of these equations can result in an F_{en} factor that range between 1.0 and approximately 4.5 depending on temperature, strain rate and water chemistry. The staff finds that the use of NUREG/CR-6335 may not be as conservative in calculating the F_{en} factor for nickel alloy components when compared to NUREG/CR-6909, which is based on more recent data and information.

Based on its review, the staff found the applicant's response unacceptable without a demonstration to show that its 1.49 value for F_{en} for alloy 600 is at least as conservative as the value calculated using NUREG/CR-6909. This is a confirmatory item CI 4.3.3.2-1.

Note 2 under LRA Table 4.3-3 states that "F_{en} are based on the specific oxygen concentrations at each specific location, adjusted for the time spent with normal water chemistry and the time spent with hydrogen water chemistry." The staff found that the quoted statement provides insufficient information on F_{en} calculations. Therefore, the staff issued RAI B.1.15-8, by letter dated May 1, 2009, requesting that the applicant provide the following information:

(a) Specific analysis method(s) used for CUF for all Class 1 components, including NUREG/CR-6260 locations. Clarify if any of the CUF values shown in LRA Tables 4.3-2 and 4.3-3 were calculated using FatiguePro, which considers only a single component of a stress tensor. If the answer is positive, describe the corrective actions taken or commitments.

(b) A summary of the F_{en} calculation for each structural component analyzed, including the values of dissolved oxygen (DO) level, temperature, and strain rate used in the calculations.

(c) A description of the equation that was used for the time and water chemistry adjusted F_{en} calculations.

(d) A summary CNS's experience in control of DO concentration in the reactor water since the plant startup. Describe all water chemistry programs CNS has used, including procedures and requirements used for managing DO concentration, as well as the inception date of each water chemistry program.

(e) A description of the control parameters used to maintain and demonstrate chemistry control and how the DO values vary with the expected and acceptable variations in these parameters.

(f) A description of how chemistry upset conditions have been considered in the F_{en} calculations.

The staff notes that RAI B.1.15-8 was initiated in SER Section 3.0.3, Fatigue Monitoring Program. On June 15, 2009, the applicant provided the response to this RAI. The details including the applicant's response and the staff's review of this RAI are fully described in Section 3.0.3, Fatigue Monitoring Program. The resolution of the RAI is listed in this SER Section.

4.3.3.3 *USAR Supplement*

The applicant provided the USAR supplement summarizing the CNS evaluation of effects of reactor coolant environment on fatigue life of components in LRA Section A.1.2.2.3. On the basis of its review of the USAR supplement, the staff concludes that the applicant provided an acceptable summary of its environmental fatigue evaluation of RCPB components.

4.3.3.4 *Conclusion*

On the basis of its review, including the applicant's responses to the RAIs, the staff concludes that, pending resolution of confirmatory item CI 4.3.3.2-1, the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of the reactor coolant environment on fatigue life of RCPB components will be adequately managed during the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of the TLAA evaluation, in accordance with 10 CFR 54.21(d).

4.4 Environmental Qualification of Electrical Equipment

The 10 CFR 50.49 Environmental Qualification (EQ) program is a TLAA for purposes of license renewal. The TLAA of the EQ of electrical components includes all long-lived, passive, and active electrical instrumentation and control (EIC) components that are important to safety and are located in a harsh environment. The harsh environments of the plant are those areas subject to environmental effects by LOCAs or high-energy line breaks. EQ equipment comprises safety-related and Q-list equipment (a list of important SSC that are used for configuration management), nonsafety-related equipment the failure of which could prevent satisfactory accomplishment of any safety-related function, and necessary post-accident monitoring equipment.

In accordance with 10 CFR 54.21(c)(1), the applicant must provide a list of EQ TLAAs. The applicant shall demonstrate that for each type of EQ equipment, one of the following is true: (1) the analyses remain valid for the period of extended operation, (2) the analyses have been projected to the end of the period of extended operation, or (3) the effects of aging on the intended functions 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 applicant's evaluation of the EQs of electric equipment for the period of extended operation and indicates that the CNS EQ of the electric equipment program is an existing program, established to meet CNS commitments for 10 CFR 50.49 and is consistent with GALL AMP X.E1, "Environmental Qualification (EQ) of Electric Components." The applicant indicated that the CNS EQ Program manages component thermal, radiation, and cyclic aging, as applicable, through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. The applicant also indicated that in accordance with 10 CFR 50.49, EQ components not qualified for the current license term are to be refurbished, replaced, or have their qualification extended prior to reaching the age limits established in the evaluation. The applicant further indicated that equipment qualification evaluation for EQ components that specify qualification of at least 40 years, but less than 60 years, are considered TLAA for license renewal. The applicant therefore concluded that, in accordance with 10 CFR 54.21(c)(1)(iii), implementation of the EQ Program provides reasonable assurance that the effects of aging on components associated with EQ TLAA will be acceptably managed so that the intended functions can be maintained for the period of extended operation.

4.4.2 Staff Evaluation

The staff reviewed LRA Section 4.4 and the associated program basis documents to determine if the applicant's EQ Program is in accordance with 10 CFR 54.21 (c)(1). The applicant's EQ Program is used to meet 10 CFR 54.21(c)(1)(iii) (to show that components evaluated under the applicant's TLAA evaluation are adequately managed during the period of extended operation). The staff reviewed the applicant's EQ Program to confirm that electric equipment requiring EQ will continue to operate consistently with the CLB during the period of extended operation.

The staff also conducted an audit of the information provided in LRA Section B.1.13, program basis documents, and reports provided to the staff during the audit. Based on the staff review of LRA Section B.1.13 and audit, the staff concludes that the applicant's EQ of Electric Components Program elements are consistent with GALL AMP X.E1. Therefore, the staff finds that the EQ Program is capable of programmatically managing the qualified life of components within the scope of program for the period of extended operation and that the continued implementation of the EQ Program provides assurance that the aging effects will be managed and that electric equipment will continue to perform their intended functions for the period of extended operation.

4.4.3 USAR Supplement

In LRA Appendix A, Section A.1.2.3, the applicant provided the USAR supplement for the EQ of Electric Components Program TLAA. The staff reviewed USAR supplement and noted that it did not include reanalysis attributes consistent with the program description of LRA Section B.1.13 and SRP-LR Table 4.4.2. GALL AMP X.E1 indicates that reanalysis of an aging evaluation is normally performed to extend the qualification by reducing excess conservatism incorporated in the prior evaluation. 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).

By letter dated June 29, 2009, the staff issued RAI B.1.13-3 to request that the applicant provide justification for not including the reanalysis attributes in the USAR supplement. The applicant responded by letter dated July 29, 2009, stating that based on a review of NUREG 1800, Revision 1, "Standard Review Plan for Review of License Renewal Applications for Nuclear

Power Plants," the NPPD concurred that CNS LRA Section A.1.2.3 credits the EQ Program to manage the effects of aging on components associated with EQ TLAA. The applicant also indicated the key EQ programmatic aspects (including reanalysis attributes) are most appropriately addressed in LRA Section A.1.1.13. Therefore, the applicant amended the LRA to discuss reanalysis attributes in CNS LRA Section A.1.1.13. With the information provided by the applicant's RAI response, the staff finds the USAR supplement acceptable because the applicant revised LRA Section A.1.1.13 consistent with the guidance of SRP-LR Table 4.4.2. The staff, therefore, considers RAI B.1.13-3 resolved.

With the revision as described above, the staff determines that the information in the USAR supplement is an acceptable summary of the program, in accordance with 10 CFR 54.21(d).

4.4.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(iii), that for EQ of electrical equipment, the effects of aging on the intended functions will be adequately managed for the period of extended operation. The staff also reviewed the USAR supplement and concludes that it provides an adequate summary description of the TLAA evaluation in accordance with 10 CFR 54.21(d), and therefore, is acceptable.

4.5 Concrete Containment Tendon Prestress

4.5.1 Summary of Technical Information in the Application

LRA Section 4.5 indicates that CNS does not have concrete containment.

4.5.2 Staff Evaluation

CNS is a BWR with a Mark I containment. The Mark I containment consists of a freestanding steel containment drywell, vent system, and steel pressure suppression chamber (torus). CNS does not have concrete containment.

4.5.3 USAR Supplement

The staff concludes that no USAR supplement is required because CNS does not have concrete containment.

4.5.4 Conclusion

CNS does not have concrete containment (not applicable)

4.6 Containment Liner Plate, Metal Containment, and Penetrations Fatigue Analysis

CNS is a BWR with a Mark I containment. The Mark I containment consists of a freestanding steel containment drywell, vent system, and steel pressure suppression chamber (torus). The original design of the drywell, torus, and vent system complies with the ASME Code, 1965 Edition with June 1967 Addenda. Containment piping systems were designed to the 1967 Edition of the USAS B31.1 and the1968 Edition of B31.7 codes. Modifications to the containment components and supports were designed, fabricated, and installed in accordance with the requirements of the ASME Code Section III, 1977 Edition, including summer 1977 Addenda.

The analysis of the CNS torus is included in the CNS plant-unique analysis (PUA) report (Reference 1) and the generic Mark I containment report, mechanical pressure regulator (MPR)-751 (Reference 2). The design-basis for the torus and associated piping and supports include evaluation for cyclic loads assumed over 40 years of plant operation with one LOCA event over the design life. The cyclical loads considered for fatigue analysis were 500 actuations (250 cycles) of S/RV and 5 OBE events (50 cycles).

4.6.1 Fatigue of the Torus Shell, Support System, Ring Girder, and Penetrations

4.6.1.1 *Summary of Technical Information in the Application*

LRA Section 4.6.1 indicates that the CUF for the torus and associated components, as documented in the CNS PUA report, for the Mark 1 Containment Program for the 40-year period is as follows:

- torus shell: 0.947
- torus support system welded connections: 0.29
- ring girder to shell weld:less than 1.0
- torus shell penetrations and attachments: within allowable limit

The applicant has proposed the use of the CNS Fatigue Monitoring Program to manage the aging effects due to fatigue of the torus shell, support system, ring girder, and penetrations through the extended period of operation. The applicant indicated that the Fatigue Monitoring Program, as described in LRA Section B.1.15, Appendix B, will monitor the cycles affecting the torus and torus welded connections (S/RV lifts and OBE) and assure that analyzed numbers of cycles are not exceeded over the 60-year period.

4.6.1.2 *Staff Evaluation*

The staff reviewed LRA Section 4.6.1 to verify, in accordance with 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation. The staff found that the CUF for the torus shell, ring girder to shell weld, and torus shell penetrations and attachments is acceptable for the cyclic loads assumed in the NPPD “Cooper Nuclear Station, Plant Unique Analysis Report, Mark I Containment Program,” (Reference 1) for 40 years of plant operation. However, the CUF will exceed the allowable limit if the number of cycles assumed in the original analysis is increased proportionately for the extended period of operation of 60 years.

The actual number of cycles for S/RV actuations as of November 21, 2008, per the LRA Table 4.6-2 was 62 as compared to 250 cycles assumed in the original fatigue analysis. In addition, the plant has not experienced a single OBE event as compared to five OBE (50 cycles) events used in the original analysis. The applicant has estimated that at the current rate of operation, there will be a total 101 S/RV actuation cycles. This is significantly less than the 250 cycles used in the original analysis. Therefore, CUF for the torus and associated components is not likely to exceed the current designed value for the 60 years of operation.

In LRA Section B.1.15, the applicant indicated that the CNS Fatigue Monitoring Program will be enhanced to include the recording of each transient associated with the actuation of the S/RV, and the program will continue to monitor plant transients to assure the fatigue design-basis is maintained so that applicable components will continue to perform their intended function consistent with the CLB through the period of extended operation. Based on this commitment by the applicant and comparison of actual and analyzed number of transient cycles for S/RV actuations and OBE events, the staff has determined that CUFs for torus shell, torus support system welded connections, ring girder to shell weld, and torus shell penetrations will remain below the code allowable value of 1.0 during the period of extended operation. The CUF of the torus shell, torus support system welded connections, ring girder to shell weld, and torus shell penetrations is directly related to the S/RV actuations. Therefore, the staff has concluded that the applicant's use of the Fatigue Monitoring Program demonstrates that the effects of aging can be managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii) .

4.6.1.3 *USAR Supplement*

The applicant provided the USAR supplement summary description of its TLAA evaluation of fatigue of the torus shell and shell to support welded connections in LRA Section A.1.2.4. On the basis of its review of the USAR supplement, the staff concludes that the summary description of the applicant's actions to address fatigue of the torus, primary containment, and attached piping is acceptable because it reflects the information provided in the LRA.

4.6.1.4 *Conclusion*

On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(iii), that the Fatigue Monitoring Program will adequately manage the aging effects due to fatigue on the torus shell for the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of the TLAA evaluation, in accordance with 10 CFR 54.21(d).

4.6.2 Fatigue of Torus Vent System

4.6.2.1 *Summary of Technical Information in the Application*

LRA Section 4.6.2 summarizes the applicant's evaluation of the torus vent system at the main vent intersection with vent header, vent header miter joint, main vent bellows, and main vent S/RV discharge line penetration. These areas were selected since local stresses are high around penetrations and intersections and joints. The applicant stated that the CUF, as documented in the NPPD "Cooper Nuclear Station, Plant Unique Analysis Report, Mark I Containment Program," at these locations for the 40 years of operation are as follows:

- main vent intersection with vent header: 0.15
- vent header miter joint: 0.34
- main vent bellows: 0.01

- main vent S/RV discharge line penetration: less than 1.0
- downcomer and tiebars: 0.49

The maximum CUF for the main vent intersection with the vent header, vent header miter joint, and downcomer and tiebars is less than 0.50. In a worst-case scenario, for an additional 20 years of plant life, the CUF would be below 0.75, less than 1.0, satisfying fatigue criteria. Similarly, the main vent bellows are qualified for 7,000 cycles with a CUF for the bellows less than 0.01. The CUF for these bellows projected over an additional 20 years of plant life would be 1.5 times the CUF for 40 years or 0.015 for 60 years. Therefore, main vent intersection with the vent header, vent header miter joint, main vent bellows, and downcomer and tiebars are in accordance with 10 CFR 54.21(c)(1)(ii).

The eight safety relief valve discharge lines (S/RVDL) are routed through the main vent and do not directly penetrate the torus or vent headers. The S/RVDL penetrations are located at the quencher discharge device located in the suppression pool. The fatigue design-basis for the S/RVDL penetration is the 250 S/RV actuations during normal plant operations, and the fatigue usage at the penetration to be below the CUF of 1.0. The total projected S/RV lifts until the end of the period of extended operation are 101, which is well below the design-basis of 250 lifts. Nevertheless, the CNS Fatigue Monitoring Program will manage the aging effects due to fatigue of the S/RVDL penetrations.

4.6.2.2 *Staff Evaluation*

The staff reviewed LRA Section 4.6.2 to verify that the effects of aging on the torus vent system has been properly evaluated and will be acceptably managed for the period of extended operation. The staff found that the CUF for the main vent intersection with the vent header, vent header miter joint, and main vent bellows (including downcomer and tiebars) projected to the end of the period of extended operation is less than 1.0 for the cyclic loads assumed in the NPPD “Cooper Nuclear Station Plant Unique Analysis Report, Mark I Containment Program,” for extended plant operation. This is in accordance with 10 CFR 54.21(c)(1)(ii).

According to Reference 1, three-quarters of the CUF for the main vent S/RV discharge piping comes from the S/RV actuation. The actual number of cycles for S/RV actuations as of November 21, 2008, per the LRA Table 4.6-2, was 62. Based on this operating experience data, the maximum number of lifts for any S/RV valve is not expected to exceed 101 until the end of 60 years of operation. This is still significantly less than the original design limit of 250 lifts for 40 years and is in accordance with 10 CFR 54.21(c)(ii). Nevertheless, the applicant stated that the CNS Fatigue Monitoring Program, as described in the LRA Section B.1.15, Appendix B, will record transients associated with the actuation of the S/RVs. Therefore, the staff has concluded that the effects of aging on the main vent S/RV discharge line penetrations will be acceptably managed for the period of extended operations, in accordance with 10 CFR 54.21(c)(1)(iii).

4.6.2.3 *USAR Supplement*

The applicant provided a USAR supplement summary description of its TLAA evaluation of fatigue of the torus vent system at the main vent intersection with vent header, vent header miter joint, main vent bellows, and main vent S/RV discharge line penetration in LRA Section A.1.2.4. On the basis of its review of the USAR supplement, the staff concludes that the summary description of the applicant’s actions to address fatigue of the torus vent system is acceptable because it reflects the information provided in the LRA.

4.6.2.4 *Conclusion*

On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(ii), that the applicant's fatigue analyses for the torus vent system main vent intersection with vent header, vent header miter joint, main vent bellows have been projected to the end of the period of extended operation. In addition, the CNS Fatigue Monitoring Program will adequately manage the aging effects due to fatigue on the main vent S/RV discharge line penetration for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii). The staff also concludes that the USAR supplement contains an appropriate summary description of the TLAA evaluation, in accordance with 10 CFR 54.21(d).

4.6.3 Safety/Relief Valve Discharge Piping

4.6.3.1 *Summary of Technical Information in the Application*

LRA Section 4.6.3 describes the applicant's evaluation of fatigue analysis of S/RV discharge piping for the period of extended operation. The applicant indicated that the CNS plant-specific analysis is bounded by the generic GE Mark 1 containment program (Reference 2) for S/RV discharge piping. The results of the GE Mark 1 program (based on 40 years of operation) concludes that for all plants and piping systems considered, in all cases the CUF is less than 0.5. In a worst case scenario, extending plant life by an additional 20 years would produce CUF of less than 0.75. The applicant concluded that this analysis thus has been projected through the period of extended operation, in accordance with 10 CFR 50.21(c)(ii).

4.6.3.2 *Staff Evaluation*

The staff reviewed LRA Section 4.6.3 to verify, in accordance with 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 information in LRA Section 4.6.3 regarding the basis of CUF in the original design and approach used to project the CUF over an additional period of 20 years. The staff has determined that the applicant's projection of CUF of less than 0.75 for all plants and piping systems of the GE Mark 1 containment system is acceptable. Since S/RV discharge piping is a part of the GE Mark 1 containment system, the staff has concluded that the CUF for the CNS S/RV discharge piping will not exceed 0.75 at the end of the period of extended operation, and the applicant's analyses for projection of the CUF is in accordance with 10 CFR 54.21(c)(1)(ii).

4.6.3.3 *USAR Supplement*

The applicant provided a USAR supplement summary description of its TLAA evaluation of fatigue of S/RV discharge piping in LRA Section A.1.2.4. On the basis of its review of the USAR supplement, the staff concludes that the summary description of the applicant's actions to address fatigue of other torus-attached piping is acceptable.

4.6.3.4 *Conclusion*

On the basis of its review, as discussed above, the staff concludes that the applicant has successfully demonstrated, in accordance with 10 CFR 54.21(c)(1)(ii), that, for fatigue of S/RV discharge piping, the analyses have been projected to the end of the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of the TLAA evaluation, in accordance with 10 CFR 54.21(d).

4.6.4 Torus-Attached Piping

4.6.4.1 *Summary of Technical Information in the Application*

LRA Section 4.6.4 describes the applicant's evaluation of fatigue analysis of the torus-attached piping (TAP) for the period of extended operation. The applicant indicated that the results of the generic GE Mark 1 containment program (based on 40 years of operation) were that 92 percent of the TAP would have a CUF of less than 0.3, and that 100 percent would have a CUF of less than 0.5. In particular, the locations reported for CNS were all less than 0.30. Conservatively multiplying the maximum CUF of 0.50 by a factor of 1.5, shows that for 60 years of operation, the CUF for the TAP will not exceed 0.75. Thus, this calculation has projected the CUF to the end of the period of extended operation, in accordance with 10 CFR 50.21(c)(ii).

4.6.4.2 *Staff Evaluation*

The staff reviewed the information in LRA Section 4.6.4 and found that the applicant's analyses performed to project the TAP CUF to the end of the period of extended operation is in accordance with 10 CFR 54.21(c)(1)(ii).

4.6.4.3 *USAR Supplement*

The applicant provided a USAR supplement summary description of its TLAA evaluation of fatigue of TAP piping in LRA Section A.1.2.4. On the basis of its review of the USAR supplement, the staff concludes that the summary description of the applicant's actions to address fatigue of the TAP is acceptable.

4.6.4.4 *Conclusion*

On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(ii), that, for fatigue of the TAP, the analyses have been projected to the end of the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of the TLAA evaluation, in accordance with 10 CFR 54.21(d).

4.6.5 Torus Piping Penetrations

4.6.5.1 *Summary of Technical Information in the Application*

LRA Section 4.6.5 describes the applicant's evaluation of fatigue analysis of the torus piping penetration assemblies, including expansion joint bellows. The bellows are designed for a minimum of 7,000 cycles over a period of 40 years. A cycle of a bellows occurs due to relative motion of the penetrating pipe because of heatup or cooldown of the system to which that pipe belongs. The applicant evaluated the validity of the assumption for 60 years of plant operation. The results of this evaluation are that 7,000 thermal cycles assumption is valid and bounding for 60 years of operation. Therefore, the pipe stress calculations remain valid for the period of extended operation, in accordance with 10 CFR 50.21(c)(1)(i).

4.6.5.2 *Staff Evaluation*

The normal heatup or cooldown in a nuclear power plant occurs during plant startup or shutdown for RFO or some other unplanned outage. The maximum number of cycles for heatup or cooldown during outages is not likely to exceed 300. Projecting this to 60 years of operations will increase the heatup or cooldown cycles to 450. This figure is considerably less than the 7,000 thermal cycles used for design of the bellows. Therefore, the staff has determined that the existing design calculations for the torus piping penetrations remains valid over the period of extended operation.

4.6.5.3 *USAR Supplement*

The applicant provided a USAR supplement summary description of its TLAA evaluation of fatigue of the torus piping penetration assemblies in LRA Section A.1.2.4. On the basis of its review of the USAR supplement, the staff concludes that the summary description of the applicant’s actions to address fatigue of torus piping penetration assemblies is acceptable.

4.6.5.4 *Conclusion*

On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(i), that, for fatigue of the torus piping penetrations, analyses remains valid for the period of extended operation.

4.7 <u>Plant-Specific Time-Limited Aging Analyses</u>

4.7.1 Core Plate Plugs

4.7.1.1 *Summary of Technical Information in the Application*

In LRA 4.7.1, the applicant stated that:

> A CNS calculation documents the evaluation for expected service life of the core plate plugs. A total of 88 plugs, each consisting of a shaft, body, body pin, latch and spring, were installed in the bypass flow holes of the core support plate to limit flow through bypass holes and reduce the flow-induced vibration of in-core neutron monitors and start-up sources against the corners of fuel assemblies. Life limits for these plugs were established based upon spring relaxation (change in material properties), radiation embrittlement (change in material properties), intergranular stress corrosion cracking (IGSCC), and fatigue. As such, the calculation is a TLAA.
>
> The evaluation concluded that core plate plugs would remain functional and will not present a loose parts concern for lives on the order of 32 EFPY as limited by spring relaxation. The predicted plug life for both spring relaxation and for stress (fatigue) cracking was determined to be 32 EFPY. As described in Section 4.3.1.3.1, the cumulative usage fatigue (CUF) would exceed 1.0 prior to 54 EFPY, therefore the BWR Vessel Internals Program will be enhanced to include management of plugs in the core plate bypass holes.

> The effects of aging associated with the core plate plugs will be managed for the period of extended operation in accordance with 10 CFR54.21(c)(1)(iii).

4.7.1.2 *Staff Evaluation*

The predicted CUF value for core plate plugs at CNS unit would exceed 1.0 prior to 54 EFPY, and to ensure the structural integrity of the core plate plugs, the applicant elected to enhance the BWRVIP RVIs AMP by replacing the core plate plugs during the period of extended operation (Commitment No. NLS2008071-4). The staff expects the applicant to adequately monitor the performance of the core plate plugs and when their structural integrity is compromised during the period of extended operation, the applicant is expected to replace them. Timely replacement of the core plate plugs is essential to ensure their performance during the extended period of operation. Based on the review of the applicant's TLAA evaluation, the staff determined that the applicant's proposal to replace core plate plugs is acceptable.

4.7.1.3 *USAR Supplement*

The applicant provided a USAR supplement summary description of its TLAA evaluation of the core plate plugs in LRA Section A.1.2.5. On the basis of its review of the USAR supplement, the staff finds that the summary description of the applicant's actions to address the core plate plugs is acceptable.

4.7.1.4 *Conclusions*

On the basis of its review, the staff concludes that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(iii), that the performance of the core plate plugs would be adequately managed during the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of the TLAA evaluation in accordance with 10 CFR 54.21(d) and therefore, is acceptable.

4.7.2 Time-Limited Aging Analysis in BWRVIP Documents

4.7.2.1 *Summary of Technical Information in the Application*

In LRA 4.7.2, the applicant stated that:

> BWRVIP-74-A, "BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines" identifies four potential TLAA that are also acknowledged in the associated NRC SER (Appendix C of BWRVIP-74-A).

The four respective potential TLAAs are discussed below in the staff's evaluation.

4.7.2.2 *Staff Evaluation*

(1) P-T Curve Analysis. Item 9 of the license renewal action items in the staff's SER for the BWRVIP-74 report requires that a set of P-T curves be developed for the heatup and cooldown operating conditions in the plant at a given EFPY during the period of extended operation. The applicant indicated that the development of P-T curves for CNS for the period of extended operation is described as a TLAA in the LRA Section 4.2.3. The staff evaluated the TLAA associated with P-T curves in this SER Section 4.2.3.

(2) Fatigue. Item 8 of the license renewal action items in the staff's SER for the BWRVIP-74 report requires that the applicant verify that the number of cycles assumed in the original fatigue design is conservative to assure that the estimated fatigue usage for 60 years of plant operation is not underestimated. The use of alternative actions for cases where the estimated fatigue usage is projected to exceed 1.0 will require case-by-case basis analysis. The applicant should address environmental fatigue for the components listed in the BWRVIP-74 report. The applicant indicated that fatigue (including discussions of cycles, projected cumulative usage factors, environmental factors, etc.) is evaluated as a TLAA in the LRA Section 4.3. The staff's evaluation on this issue is addressed in this SER Section 4.3.

(3) Equivalent Margin Analysis. Item 10 of the license renewal action items in the staff's SER for the BWRVIP-74 report requires that the applicant evaluate the percent reduction in Charpy USE for the belt line materials for the period of extended operation. The applicant stated that the TLAA evaluation of USE is addressed in the LRA Section 4.2.4. The staff evaluated the TLAA associated with the USE criteria for the RPV beltline materials in this SER Section 4.2.4.

(4) Reactor Vessel Circumferential Examination Relief. Item 11 of the license renewal action items in the staff's SER for the BWRVIP-74 report requires that the applicant obtain relief from the ISI of the circumferential welds during the period of extended operation. The BWRVIP-05 report requires that each applicant will have to demonstrate that (1) at the end of the renewal period, the circumferential welds will satisfy the limiting conditional failure frequency for circumferential welds in Appendix E for the staff's SE dated July 28, 1998, on the BWRVIP-05 report, and (2) that they have implemented operator training and established procedures that limit the frequency of cold over-pressure events to the amount specified in the staff's SE dated July 28, 1998, on the BWRVIP-05 report. The applicant stated that the discussion of the relief from the ISI of the circumferential welds at CNS for the period of extended operation is described in LRA Section 4.2.5. The staff evaluated the TLAA associated with the relief from the ISI of the RPV circumferential shell welds for CNS, and the staff's evaluation is addressed in this SER Section 4.2.5.

4.7.2.3 *USAR Supplement*

The applicant provided a USAR supplement summary description of its TLAA evaluations for: (a) the P-T curve analysis in LRA Section A.1.2.1.3, (b) fatigue in LRA Section A.1.2.2, (c) EMA for USE in LRA Section A.1.2.1.4, and (d) reactor vessel circumferential weld inspection relief in LRA Section A.1.2.1.5. On the basis of its review of the USAR supplements, the staff finds that the summary description of the applicant's actions to address the aforementioned TLAA is acceptable.

4.7.2.4 *Conclusions*

On the basis of its review, the staff concludes that the applicant has demonstrated, in accordance with 10 CFR 54.21(c)(1)(ii) and (c)(1)(iii) that the applicant adequately addressed its TLAA evaluations for P-T Curve Analysis, Fatigue, EMA for USE, and reactor vessel circumferential weld inspection relief for the end of the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of the aforementioned TLAA evaluations that are in accordance with 10 CFR 54.21(d) and therefore, are acceptable.

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 a sufficient list of TLAAs in accordance with 10 CFR 54.3 and that the applicant has demonstrated that: (1) the TLAAs will remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i); (2) the TLAAs have been projected to the end of the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii); or (3) that the effects of aging on intended functions will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii). The staff also reviewed the USAR supplement for the TLAAs and finds that the supplement contains descriptions of the TLAAs in accordance with 10 CFR 54.21(d). In addition, the staff concludes that no plant-specific TLAA-based exemptions are in effect, in accordance with 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 licenses will continue to be conducted in accordance with the CLB and that any changes made to the CLB in order to comply with 10 CFR 54.29(a) are in accordance with the Atomic Energy Act of 1954, as amended, and NRC regulations.

SECTION 5

REVIEW BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

In accordance with Title 10, Part 54, of the *Code of Federal Regulations* (10 CFR 54), the Advisory Committee on Reactor Safeguards (ACRS) will review the license renewal application (LRA) for Cooper Nuclear Station. The ACRS Subcommittee on Plant License Renewal will continue its detailed review of the LRA after this safety evaluation report (SER) is issued. Nebraska Public Power District (NPPD) (the applicant) and the staff of the U.S. Nuclear Regulatory Commission (NRC) (the staff) will meet with the subcommittee and the full committee to discuss issues associated with the review of the LRA.

After the ACRS completes its review of the LRA and SER, the full committee will issue a report discussing the results of the review. An update to this SER will include the ACRS report and the staff's response to any issues and concerns reported.

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SECTION 6

CONCLUSION

The staff of the U.S. Nuclear Regulatory Commission (NRC) (the staff) reviewed the license renewal application (LRA) for Cooper Nuclear Station in accordance with NRC regulations and NUREG-1800, Revision 1, “Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants,” dated September 2005. Title 10, Section 54.29, of the *Code of Federal Regulations* (10 CFR 54.29) sets the standards for issuance of a renewed license.

On the basis of its review of the LRA, the staff determines that, pending resolution of the confirmatory items and open items, 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 41, “Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding Cooper Nuclear Station Unit 1 Report,” is scheduled to be issued in 2010.

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APPENDIX A

COOPER NUCLEAR STATION
LICENSE RENEWAL COMMITMENTS

During the review of the Cooper Nuclear Station (CNS), license renewal application (LRA) by the staff of the U.S. Nuclear Regulatory Commission (NRC) (the staff), Nebraska Public Power District (NPPD or the applicant) made commitments related to aging management programs (AMPs) to manage aging effects for structures and components. The following table lists these commitments along with the implementation schedules and sources for each commitment.

APPENDIX A: CNS LICENSE RENEWAL COMMITMENTS				
Item Number	**Commitment**	**Updated Safety Analysis Report (USAR) Supplement Section/ LRA Section**	**Commited Date**	**Commitment Number**
1	Implement the Aboveground Steel Tanks Program. The thickness measurements will be performed at least once during the first ten years of the period of extended operation and periodically thereafter. The results of the initial inspection will be used to determine the frequency of subsequent inspections.	A.1.1.1/B.1.1	January 18, 2014	NLS2008071-1, (Revision 1)
2	Enhance the Bolting Integrity Program to include guidance from EPRI NP-5769 and EPRI TR-104213 for material selection and testing, bolting preload control, ISI, plant operation and maintenance, and evaluation of the structural integrity of bolted joints. Enhance the program to clarify that actual yield strength is used in selecting materials for low susceptibility to SCC, to clarify the prohibition on use of lubricants containing MoS_2 for bolting at CNS, and to specify that proper gasket compression will be visually verified following assembly. Enhance the program to include guidance from EPRI NP-5769 and EPRI TR-104213 for replacement of non-Class 1 bolting and disposition of degraded structural bolting.	A.1.1.2/B. 1.2	January 18, 2014	NLS2008071-2
3	Implement the Buried Piping and Tanks Inspection Program.	A.1.1.3/B. 1.3	January 18, 2014	NLS2008071-3
4	Enhance the BWR Vessel Internals Program to include actions to replace the plugs in the core plate bypass holes based on their qualified life.	A.1.1.9/B. 1.9	January 18, 2014	NLS2008071-4

APPENDIX A: CNS LICENSE RENEWAL COMMITMENTS				
Item Number	**Commitment**	**Updated Safety Analysis Report (USAR) Supplement Section/ LRA Section**	**Commited Date**	**Commitment Number**
5	Enhance the Containment Inservice Inspection Program to add examination of required accessible areas using a visual examination method and surface areas not accessible on the side requiring augmented examination to be examined using an ultrasonic thickness measurement method in accordance with IWE-2500(b). Enhance the program to document material loss in a local area exceeding 10% of the nominal containment wall thickness or material loss in a local area projected to exceed 10% of the nominal containment wall thickness before the next examination in accordance with IWE-3511.3 for volumetric inspections. To ensure the [drywell sand cushion drain] lines are obstruction free, a vacuum test of all eight sand bed drain lines will be performed prior to the period of extended operation (PEO).	A.1.1.10/B. 1.10	January 18, 2014	NLS2008071-5, (Revision 1)

APPENDIX A: CNS LICENSE RENEWAL COMMITMENTS				
Item Number	**Commitment**	**Updated Safety Analysis Report (USAR) Supplement Section/ LRA Section**	**Commited Date**	**Commitment Number**
6	Enhance the Diesel Fuel Monitoring Program to include the use of ASTM Standard D4057 for sampling of the diesel fire pump fuel oil storage tank. Enhance the Diesel Fuel Monitoring Program to include periodic visual inspections and cleaning of the diesel fuel oil day tanks, the diesel fuel oil storage tanks, and the diesel fire pump fuel oil storage tank. Enhance the program to include periodic multilevel sampling of the diesel fuel oil day tanks and the diesel fire pump fuel oil storage tank and to include periodic visual inspections as well as ultrasonic bottom surface thickness measurement of the diesel fuel oil day tanks, the diesel fuel oil storage tanks, and the diesel fire pump fuel oil storage tank. Enhance the program to provide the acceptance criterion of $\leq$ 10 mg/l for the determination of particulates in the diesel fire pump fuel oil storage tank. Enhance the program to specify acceptance criterion for UT thickness measurements of the bottom surfaces of the diesel fuel oil day tanks, the diesel fuel oil storage tanks, and the diesel fire pump fuel oil storage tank. The acceptance criteria for UT measurement of tank bottom thickness for the referenced diesel fuel tanks will be based on component as-built information adjusted for corrosion allowance. If measurements show less than the minimum nominal thickness less corrosion allowance, engineering will evaluate the measured thickness for acceptability under the corrective action program. Evaluation will include consideration of potential future corrosion to ensure that future inspections are scheduled before wall thickness becomes unacceptable.	A.1.1.12/B. 1. 12	January 18, 2014	NLS2008071-6, (Revision 1)

APPENDIX A: CNS LICENSE RENEWAL COMMITMENTS

Item Number	Commitment	Updated Safety Analysis Report (USAR) Supplement Section/ LRA Section	Commited Date	Commitment Number
7	Enhance the External Surfaces Monitoring Program to clarify that periodic 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) will be performed. 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).	A.1.1.14/B.1.14	January 18, 2014	NLS2008071-7

APPENDIX A: CNS LICENSE RENEWAL COMMITMENTS

Item Number	Commitment	Updated Safety Analysis Report (USAR) Supplement Section/ LRA Section	Commited Date	Commitment Number
8	Consideration of the effect of the reactor water environment will be accomplished through implementation of one or more of the following options for the feedwater nozzles, core spray nozzles and RHR pipe transition. (1) Update the fatigue usage calculations using refined fatigue analyses to determine valid CUFs less than 1.0 when accounting for the effects of reactor water environment. This includes applying the appropriate F_{en} factors to valid CUFs determined using an NRC-approved version of the ASME code or NRC-approved alternative (e.g., NRC-approved code case). (2) Repair or replace the affected locations before exceeding an environmentally adjusted CUF of 1.0. The CNS Fatigue Monitoring Program will be enhanced to require the recording of each transient associated with the actuation of a safety/relief valve (SRV).	A.1.1.15/B.1.15	January 18, 2014	NLS2008071-8, (Revision 1)

APPENDIX A: CNS LICENSE RENEWAL COMMITMENTS				
Item Number	**Commitment**	**Updated Safety Analysis Report (USAR) Supplement Section/ LRA Section**	**Commited Date**	**Commitment Number**
9	Enhance the Fire Protection Program to explicitly state that the diesel fire pump engine sub-systems (including the fuel supply line) shall be observed while the engine is running. Acceptance criteria will be revised to verify that the diesel engine does not exhibit signs of degradation while running, such as excessive fuel oil, lube oil, or exhaust gas leakage. Enhance the program to specify that diesel fire pump engine carbon steel exhaust components are inspected for evidence of corrosion or cracking at least once every five years. Enhance the program to require visual inspections of fire damper framing to check for signs of degradation. Enhance the program to require visual inspections of the Halon and $C0_2$ fire suppression systems at least once every six months to check for signs of degradation in a manner suitable for trending. Enhance the program to include inspection of cardox hose reels for corrosion. Acceptance criteria will be enhanced to verify no unacceptable corrosion. Enhance the program to require visual inspection of concrete flood curbs, manways, hatches, and hatch covers on an 18-month basis to check for signs of degradation.	A.1.1.16/B. 1.16	January 18, 2014	NLS2008071-9

APPENDIX A: CNS LICENSE RENEWAL COMMITMENTS

Item Number	Commitment	Updated Safety Analysis Report (USAR) Supplement Section/ LRA Section	Commited Date	Commitment Number
10	Enhance the Fire Water System Program to include inspection of hose reels for corrosion. Acceptance criteria will be enhanced to verify no unacceptable corrosion. Enhance the program to include visual inspection of spray and sprinkler system internals for evidence of corrosion. Acceptance criteria will be enhanced to verify no unacceptable corrosion. Enhance the program to provide wall thickness evaluations of fire protection piping on system components using non-intrusive 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. Enhance the program to add that a sample of sprinkler heads required for 10 CFR 50.48 will be tested or replaced using guidance of NFPA-25 (2002 edition), Section 5.3.1.1.1, before the end of the 50-year sprinkler head service life and at 10-year intervals thereafter during the period of extended operation.	A.1.1.17/B.1.17	January 18, 2014	NLS2008071-10
11	Enhance the Flow-Accelerated Corrosion Program to update the System Susceptibility Analysis for this program to reflect the lessons learned and new technology that became available after the publication of NSAC-202L Revision 1. Program guidance documents will be revised to stipulate requirements for training and qualification of non-CNS personnel involved in implementing the FAC program.	A.1.1.18/B.1.18	January 18, 2014	NLS2008071-11 (Revision 1)

APPENDIX A: CNS LICENSE RENEWAL COMMITMENTS				
Item Number	**Commitment**	**Updated Safety Analysis Report (USAR) Supplement Section/ LRA Section**	**Commited Date**	**Commitment Number**
12	Enhance the Inservice Inspection - IWF Program to include Class MC piping and component supports. Enhance the program to clarify that the successive inspection requirements of IWF-2420 and the additional examination requirements of IWF-2430 will be applied.	A.1.1.20/B.1.20	January 18, 2014	NLS2008071-12
13	Enhance the Masonry Wall Program to clarify that the control house - 161 kV switchyard is included in the program. Enhance the program to clarify that structures with conditions classified as "acceptable with deficiencies" or "unacceptable" shall be entered into the Corrective Action Program.	A.1.1.21/B.1.21	January 18, 2014	NLS2008071-13
14	Implement the Metal-Enclosed Bus Inspection Program.	A.1.1.22/B.1.22	January 18, 2014	NLS2008071-14
15	Implement the Non-EQ Bolted Cable Connections Program.	A.1.1.24/B.1.24	January 18, 2014	NLS2008071-15
16	Implement the Non-EQ Inaccessible Medium- Voltage Cable Program.	A.1.1.25/B.1.25	January 18, 2014	NLS2008071-16
17	Implement the Non-EQ Instrumentation Circuits Test Review Program.	A.1.1.26/B.1.26	January 18, 2014	NLS2008071-17
18	Implement the Non-EQ Insulated Cables and Connections Program.	A.1.1.27/B.1.27	January 18, 2014	NLS2008071-18

APPENDIX A: CNS LICENSE RENEWAL COMMITMENTS

Item Number	Commitment	Updated Safety Analysis Report (USAR) Supplement Section/ LRA Section	Commited Date	Commitment Number
19	Enhance the Oil Analysis Program to include viscosity, neutralization number, and flash point determination of oil samples from components that do not have regular oil changes, along with analytical ferrography and elemental analysis for the identification of wear particles. Enhance the program to include screening for particulate and water content for oil replaced periodically. Enhance the program to formalize preliminary oil screening for water and particulates and laboratory analyses, including defined acceptance criteria for all components included in the scope of the program. The program will specify corrective actions in the event acceptance criteria are not met.	A.1.1.28/B.1.28	January 18, 2014	NLS2008071-19
20	Implement the One-time Inspection Program.	A.1.1.29/B.1.29	January 18, 2014	NLS2008071-20
21	Implement the One-time Inspection Small-Bore Piping Program.	A.1.1.30/B.1.30	January 18, 2014	NLS2008071-21
22	Enhance the Periodic Surveillance and Preventive Maintenance Program to include the activities described in the table provided in the program description of LRA Section B. 1.31. For each activity that refers to a representative sample, a representative sample will be selected for each unique material and environment combination. The sample size will be determined in accordance with Chapter 4 of EPRI 107514, *Age-Related Degradation Inspection Method and Demonstration*, which outlines a method to determine the number of inspections required for 90% confidence that 90% of the population does not experience degradation.	A.1.1.31/B.1.31	January 18, 2014	NLS2008071-22

APPENDIX A: CNS LICENSE RENEWAL COMMITMENTS				
Item Number	**Commitment**	**Updated Safety Analysis Report (USAR) Supplement Section/ LRA Section**	**Commited Date**	**Commitment Number**
23	Enhance the Reactor Vessel Surveillance Program to add that if the CNS standby capsule is removed from the reactor vessel without the intent to test it, the capsule will be stored in a manner which maintains it in a condition which would permit its future use, including during the period of extended operation. Enhance the program to ensure that the additional requirements that are specified in the final NRC safety evaluation for BWRVIP-116 will be addressed before the period of extended operation.	A.1.1.33/B.1.33	January 18, 2014	NLS2008071-23
24	Implement the Selective Leaching Program.	A.1.1.34/B.1.34	January 18, 2014	NLS2008071-24

APPENDIX A: CNS LICENSE RENEWAL COMMITMENTS				
Item Number	**Commitment**	**Updated Safety Analysis Report (USAR) Supplement Section/ LRA Section**	**Commited Date**	**Commitment Number**
25	Revise procedures to ensure the structures described in the LRA Section B. 1.36 table are included in the program. Revise procedures to ensure the commodities described in the LRA Section B.1.36 table are inspected, as applicable. Enhance the Structures Monitoring Program to add guidance to inspect inaccessible concrete areas that are submerged or below grade which may become exposed due to excavation, construction or other activities. CNS will also inspect inaccessible concrete areas when observed conditions in accessible areas exposed to the same environment indicate that significant concrete degradation is occurring. Enhance the Structures Monitoring Program to perform inspections of elastomers (seals, gaskets, and roof elastomers) to identify cracking and change in material properties. Enhance the Structures Monitoring Program to perform an engineering evaluation of groundwater samples to assess aggressiveness of groundwater to concrete on a periodic basis (at least once every five years). CNS will obtain samples from a well that is representative of the groundwater surrounding below-grade site structures. Samples will be monitored for Sulfates, pH and chlorides. Enhance the Structures Monitoring Program to add guidance to perform visual structural examinations of wood to identify loss of material and change in material properties. Enhance the Structures Monitoring Program to add guidance to perform visual structural monitoring of the oil tank bunker crushed rock fill to identify loss of form.	A.1.1.36/B.1.36	January 18, 2014	NLS2008071-25, (Supplement 1)

APPENDIX A: CNS LICENSE RENEWAL COMMITMENTS

Item Number	Commitment	Updated Safety Analysis Report (USAR) Supplement Section/ LRA Section	Commited Date	Commitment Number
25, cont.	Enhance the Structures Monitoring Program to clarify that structures with conditions classified as "acceptable with deficiencies" or "unacceptable" shall be entered into the Corrective Action Program. Supplement 1: NPPD will enhance the Structures Monitoring Program procedure to: a) include more detailed guidance on acceptance criteria (using ACI documents ACI 201.1R-92, and ACI 349.3R-96) to preclude potential inconsistent application of inspection criteria, and b) provide more detailed guidance on trending.	A.1.1.36/B.1.36	January 18, 2014	NLS2008071-25 (Supplement 1)
26	Implement the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program.	A.1.1.37/B.1.37	January 18, 2014	NLS2008071-26
27	NPPD will submit (or otherwise make available for NRC review and approval) a complete proprietary version of an analysis of the core plate rim bolts that demonstrates their adequacy considering potential loss of pre-load through the period of extended operation. This will be provided at least two years prior to the period of extended operation. NPPD expects to satisfy this commitment using the generic analysis being developed by the BWRVIP, provided that it is applicable to CNS.	A.1.1.9/B.1.9	January 18, 2012	NLS2009100-1 (Revision 1)
28	NPPD will confirm that there are no niobium-bearing CASS materials used for vessel internal components, or provide a flaw evaluation methodology for niobium-bearing CASS internal components for staff review and approval. This will be provided at least two years prior to the period of extended operation. NPPD expects to implement this commitment by a generic analysis sponsored by the BWRVIP in collaboration with EPRI.	A.1.1.37/B.1.37	January 18, 2012	NLS2009100-2,

APPENDIX A: CNS LICENSE RENEWAL COMMITMENTS				
Item Number	**Commitment**	**Updated Safety Analysis Report (USAR) Supplement Section/ LRA Section**	**Commited Date**	**Commitment Number**
29	NPPD will confirm there are no CASS materials with greater than 25% ferrite or provide a flaw evaluation methodology for CASS internal components with greater than 25% ferrite for staff review and approval. This will be provided at least two years prior to the period of extended operation. NPPD expects to implement this commitment by a generic analysis sponsored by the BWRVIP in collaboration with EPRI.	A.1.1.37/B.1.37	January 18, 2012	NLS2009100-3,
30	NPPD will implement the plant modifications designed to correct the main steam line support discrepancies noted in RAI B.1.20-1 prior to the period of extended operation.	A.1.1.20/B.1.20	January 18, 2014	NLS2010019-01
31	To verify there is no loss of neutron absorbing capacity of the Boral material, NPPD will supplement the Neutron Absorber Monitoring Program to include neutron attenuation testing of representative sample coupons. Acceptance criteria will be that measured or analyzed neutron-absorber capacity required to ensure the 5% subcriticality margin for the spent fuel pool is maintained assuming neutron absorber degradation is the only mechanism. Results not meeting the acceptance criteria will be entered into the CNS Corrective Action Program for disposition. One test will be performed prior to the period of extended operation (PEO), with another confirmatory test performed within the first 10 years of the PEO.	A.1.1.23/B.1.23	January 18, 2014	NLS2010019-02

APPENDIX B

CHRONOLOGY

This appendix lists chronologically the routine licensing correspondence between the staff of the U.S. Nuclear Regulatory Commission (NRC) (the staff) and Nebraska Public Power Disctrict (NPPD). This appendix also lists other correspondences on the staff's review of the Cooper Nuclear Station (CNS) license renewal application (LRA) (under Docket No. 50-298).

APPENDIX B: CHRONOLOGY		
Date	**Subject**	**ADAMS Accession Number**
September 24, 2008	Transmittal Letter of CNS, Regarding LRA.	ML083030225
November 10, 2008	NRC. NPPD Notice of Receipt and Availability of Application for Renewal of Cooper Nuclear Station Facility Operating License No. DPR-46 for an Additional 20-Year Period. Docket No. 50-298.	ML082660892
November 10, 2008	Receipt and Availability of the LRA for CNS.	ML082661007
December 19, 2008	Determination of Acceptability and Sufficiency for Docketing and Opportunity for a Hearing Regarding the Application from NPPD, for Renewal of the Operating License for CNS. (TAC MD9763 and MD9791).	ML083330066
January 29, 2009	Notice of Forthcoming Meeting to Discuss the Safety Review Process and Environmental Scoping Process for CNS, LRA Review, February 25, 2009.	ML090160280
April 3, 2009	Proposed Review Schedule Regarding the Application from NPPD for Renewal of the Operating License for CNS. (TAC NO. MD9763 and MD9737).	ML090220584
April 9, 2009	Audit Plan for Aging Management Program (AMP) Site Audit Regarding CNS, LRA (TAC No. MD9737).	ML090930256
April 28, 2009	CNS. Request for Additional Information for LRA, AMP Audit April 20-24, 2009.	ML091400101
May 1, 2009	Request for Additional Information for the Review of CNS LRA (TAC No. MD9763 and MD9737).	ML091190597
May 1, 2009	Request for Additional Information for CNS LRA.	ML091190637
May 28, 2009	CNS. Response to Request for Additional Information for LRA, Balance-of-Plant Scoping and Screening.	ML091530425
June 8, 2009	Request for Additional Information For the Review of CNS LRA.	ML091530316

APPENDIX B: CHRONOLOGY		
Date	**Subject**	**ADAMS Accession Number**
June 10, 2009	Summary of Telephone Conference Call Held on May 20, 2009, between the staff and NPPD, related to a Clarification on Certain Requests for Additional Information (RAIs) (RAI B.1.15-3 and RAI B.1.15-4), for CNS Renewal.	ML091560496
June 11, 2009	Summary of Teleconference Held on May 27, 2009, between the staff and NPPD, related to a Clarification on Certain RAIs (RAI 3.3.2.2.3.3-1, RAI 3.3.2.2.7.3-1, and RAI 3.3.2.2.7.3-2), for CNS License Renewal.	ML091590022
June 15, 2009	Audit Report Regarding CNS, LRA (TAC MD9763).	ML091380365
June 15, 2009	CNS. Response to Request for Additional Information for LRA - AMPs.	ML091690050
June 22, 2009	CNS. Response to Request for Additional Information for LRA - Sections B and C.	ML091800024
June 29, 2009	RAI for the Review of CNS LRA.	ML091600278
June 29, 2009	RAI for CNS LRA.	ML091600289
July 1, 2009	Summary of Regulatory Audit Related to the Review of CNS LRA.	ML091750368
July 1, 2009	CNS. Response to RAI for LRA Severe Accident Mitigation Alternatives.	ML091880319
July 14, 2009	RAI for the Review of CNS LRA.	ML091880482
July 14, 2009	RAI for the Review of CNS LRA.	ML091900502
July 16, 2009	RAI for the Review of CNS LRA.	ML091870298
July 16, 2009	CNS License Renewal RAI.	ML091870304
July 29, 2009	Summary of Telephone Conference Call Held on July 9, 2009, between the staff and NPPD, related to a Clarification for Certain RAIs, for CNS License Renewal.	ML092030305
July 29, 2009	RAI for the Review of CNS LRA (TACs MD9763 and MD9737).	ML092090276
July 29, 2009	CNS. Response to RAI for LRA.	ML092160083
August 13, 2009	CNS. Response to RAI for the Review of the LRA.	ML092400412
August 17, 2009	CNS. Response to RAI for LRA.	ML092310146
August 19, 2009	Summary of Regulatory Audit Related to the Review of CNS LRA.	ML091960040

APPENDIX B: CHRONOLOGY		
Date	**Subject**	**ADAMS Accession Number**
August 25, 2009	Summary of Telephone Conference Call Held on June 16, 2009, between the staff and NPPD, related to a Clarification for Certain RAIs for CNS License Renewal.	ML092010399
August 25, 2009	Summary of Telephone Conference Call Held on June 16, 2009, between the staff and NPPD, related to a Clarification for Certain RAIs, for CNS License Renewal.	ML092010399
August 28, 2009	RAI for the Review of the CNS LRA.	ML092310654
September 17, 2009	Summary of Telephone Conference Call Held on July 7, 2009 between the staff and NPPD, related to a Clarification for Certain RAIs for CNS License Renewal.	ML092380434
September 24, 2009	CNS. Response to RAI for LRA.	ML092730179
September 28, 2009	RAI for the Review of the CNS LRA.	ML092650057
October 7, 2009	RAI For the Review of CNS LRA.	ML092680935
October 8, 2009	Summary of Telephone Conference Call Held on September 2, 2009, between the staff and NPPD, related to a Clarification for Certain Responses to RAIs, for CNS License Renewal.	ML092680569
October 15, 2009	07/27/2009 Summary of Teleconference Call Held Between the NRC and Nebraska Public Power District Related to Clarifications on Request for Additional Information for Cooper.	ML092300718
October 19, 2009	Request for Additional Information for the Review of the Cooper Nuclear Station License Renewal Application.	ML092730014
October 22, 2009	Response to Request for Additional Information on License Renewal Application.	ML093000117
October 28, 2009	Summary of Telephone Conference Call Held on 9/17/09, Between the NRC and Nebraska Public Power District, Related to a Clarification for Certain Responses to Requests for Additional Information, for Cooper Nuclear Station License Renewal.	ML092940524
October 28, 2009	Summary of Telephone Conference Call Held on 09/14/09, Between the U.S. NRC staff and NPPD, Related to a Request for Additional Information (RAI) and Clarification for Certain Responses to RAIs, for Cooper Nuclear Station License Renewal.	ML092920026
October 29, 2009	Summary of Telephone Conference Call Held on October 5, 2009, Between the NRC Staff and Nebraska Public Power District, Related to a Clarification for Certain Responses to Requests for Additional Information, for CNS LRA.	ML092870693

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Date	**Subject**	**ADAMS Accession Number**
October 29, 2009	Request for Additional Information for the Review of the Cooper Nuclear Station License Renewal Application.	ML092920019
October 29, 2009	Request for Additional Information for the Review of the Cooper Nuclear Station License Renewal Application.	ML092940414
November 4, 2009	Cooper Nuclear Station - Response to Request for Additional Information for the Review of License Renewal Application.	ML093130069
November 9, 2009	Summary of Telephone Conference Call Held on August 6, 2009, and September 2, 2009, Between the NRC Staff and Nebraska Public Power District, Related to a Clarification for Responses to Certain RAIs, for CNS License Renewal.	ML092990400
November 16, 2009	Cooper, Response to Request for Additional Information for the Review of the License Renewal Application.	ML093240080
November 18, 2009	09/21/2009-Summary of Telephone Conference, Between USNRC Staff and Nebraska Public Power District, Related to a Clarification for Certain Responses to RAI, for Cooper Nuclear Station License Renewal.	ML093000440
November 19, 2009	Request for Additional Information For the Review of the Cooper Nuclear Station License Renewal Application (TAC Nos. MD9763 & MD9737).	ML093210573
November 30, 2009	Cooper Nuclear Station - Response to Request for Additional Information for the Review of License Renewal Application.	ML093370089
December 21, 2009	Response to Request for Additional Information for the Review of Cooper Nuclear Station License Renewal Application.	ML100050070
December 23, 2009	Cooper - License Renewal Application Annual Update.	ML093630334
January 21, 2010	November 9, 2009, Summary of Telephone Conference Call Between the NRC Staff and Nebraska Public Power District, Related to a Clarification for Certain Responses to Requests for Additional Information for Cooper License Renewal.	ML100090047
January 22, 2010	Summary of Tele Conf Call Held on 12/2/09, Between the NRC Staff and NPPD, Related to a Clarification for Certain Responses to Requests for Additional Information, for Cooper Nuclear Station License Renewal	ML100110305
February 26, 2010	Summary of Tele Conf Call Held on 1/14/2010, Between the NRC Staff and NPPD, Related to a Clarification for Certain Responses to Requests for Additional Information, for Cooper Nuclear Station License Renewal	ML100290169
March 25, 2010	Supplemental Information for the Review of Cooper Nuclear Station License Renewal Application	

APPENDIX B: CHRONOLOGY		
Date	**Subject**	**ADAMS Accession Number**
March 29, 2010	Consolidated Commitment List Associated with the Review of Cooper Nuclear Station License Renewal Application	
	Summary of Tele Conf Call Held on 1/20/2010, Between the NRC Staff and NPPD, Related to a Clarification for Certain Responses to Requests for Additional Information, for Cooper Nuclear Station License Renewal	ML100710645

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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**
A. Hiser	Management Oversight
A. Klein	Management Oversight
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A. Sheikh	Reviewer—Structural
A. Wong	Reviewer—Mechanical
B. Brady	Reviewer—Mechanical, Project Management
B. Fu	Reviewer—Mechanical
B. Harris	Reviewer—Mechanical
B. Holian	Management Oversight
B. Pham	Management Oversight
B. Rogers	Reviewer—Scoping and Screening Methodology
C. Doutt	Reviewer—Electrical
C. Yang	Reviewer—Mechanical
D. Alley	Reviewer—Mechanical
D. Hoang	Reviewer—Structural
D. Nguyen	Reviewer—Electrical
D. Pelton	Management Oversight
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E. Wong	Reviewer—Chemical
F. Farzam	Reviewer—Structural
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APPENDIX C: PRINCIPAL CONTRIBUTORS	
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J. Dozier	Management Oversight
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J. Miller	Reviewer—Mechanical
M. Mitchell	Management Oversight
N. Iqbal	Reviewer—Fire Protection
O. Hopkins	Reviewer—Balance of Plant
O. Obodoako	Reviewer—Chemical
O. Yee	Reviewer—Mechanical
P. Gerard	Reviewer—Balance of Plant
R. Auluck	Management Oversight
R. Dennig	Management Oversight
R. Li	Reviewer—Electrical
R. Sun	Reviewer—Mechanical
S. Gardocki	Reviewer—Balance of Plant
S. Lee	Management Oversight
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Thomas Associates, Inc.	SER Support
W. Smith	Reviewer—Mechanical

APPENDIX D

REFERENCES

This appendix lists the references used throughout this safety evaluation report (SER) for review of the license renewal application (LRA) for Cooper Nuclear Station (CNS).

APPENDIX D: REFERENCES	
Item Number	**Reference**
1	CNS License Renewal Application, dated September 24, 2008.
2	NUREG-1800, Revision 1, “Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants,” September 2005.
3	NUREG-1801, Revision 1, “Generic Aging Lessons Learned (GALL) Report,” September 2005.
4	10 CFR 50, “Domestic Licensing of Production and Utilization Facilities.”
5	10 CFR 54, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants.”
6	Regulatory Guide (RG) 1.188, “Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses.”
7	NEI 95-10, Revision 6, “Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule,” June 2005.
9	10 CFR Part 100, “Reactor Site Criteria.”
10	CNS-RPT-07-LRD02, “CNS License Renewal Project, Aging Management Program Evaluation Report Class 1 Mechanical, BWR Penetrations.”
11	NUREG-0619, “BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking,” November 1980.
12	Boiling Water Reactor Vessel Internals Program (BWRVIP)-27-A, “BWRVIP Standby Liquid Control System/Core Spray/ Core Plate ΔP Inspection and Flaw Evaluation Guidelines.”
13	Boiling Water Reactor Vessel Internals Program (BWRVIP)-49-A,” Instrument Penetration Inspection and Flaw Evaluation Guidelines.”
14	Boiling Water Reactor Vessel Internals Program (BWRVIP)-130, “Water Chemistry.”
15	Boiling Water Reactor Vessel Internals Program (BWRVIP)-29, “BWR Water Chemistry Guidelines.”
16	EPRI Document 107514, “Age-Related Degradation Inspection Method and Demonstration.”
17	Generic Letter 89-13
18	NUREG-1339, “Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants.”

APPENDIX D: REFERENCES	
Item Number	**Reference**
19	EPRI TR-104213, “Bolted Joint Maintenance & Applications Guide.”
20	EPRI NP-5769, “Degradation and Failure of Bolting in Nuclear Power Plants.”
21	Generic Letter 88-01, “NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping,” January 1988, Supplement 1, September 1992.
22	Boiling Water Reactor Vessel Internals Program (BWRVIP)-48-A, “Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines.”
23	BWRVIP-18-A, “BWR Core Spray Inspection and Flaw Guidelines.”
24	Boiling Water Reactor Vessel Internals Program (BWRVIP)-25, “BWR Core Plate Inspection and Flaw Evaluation Guidelines.”
25	Boiling Water Reactor Vessel Internals Program (BWRVIP)-26-A, “BWR Top guide Inspection and Flaw Evaluation Guidelines.”
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