UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 2, 2010

Mr. Christopher Costanzo
Vice President, Nuclear Plant Support
NextEra Energy Duane Arnold, LLC
P.O. Box 14000
Juno Beach, FL 33408-0420

SUBJECT: SAFETY EVALUATION REPORT RELATED TO THE LICENSE RENEWAL OF DUANE ARNOLD ENERGY CENTER

Dear Mr. Costanzo:

By letter dated September 30, 2008, as supplemented by letter dated January 23, 2009, FPL Energy Duane Arnold, LLC (the applicant), submitted, for the U.S. Nuclear Regulatory Commission's (NRC or the staff) review, an application to renew the Duane Arnold Energy Center (DAEC) operating license for up to an additional 20 years. The license renewal application (LRA) was submitted pursuant to Title 10 of the *Code of Federal Regulations* Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants." The staff determined that the LRA was complete and acceptable for docketing on February 11, 2009.

Since that time, the staff has reviewed the DAEC LRA, issued requests for additional information (RAIs), reviewed the applicant's responses to the staff's RAIs, developed a safety evaluation report (SER) with open items, and reviewed the applicant's comments on the SER with open items. The SER was discussed at an Advisory Committee on Reactor Safeguards (ACRS) subcommittee meeting on June 8, 2010. On the basis of this review, the staff has developed the enclosed SER to document its findings associated with the safety review of the LRA and supporting documentation for DAEC.

This SER is scheduled to be discussed at the ACRS full committee meeting on October 7, 2010.

If you have any questions regarding this matter, please contact the license renewal project manager, Brian Harris, at 301-415-2277 or by e-mail at Brian.Harris2@nrc.gov.

Sincerely,

Melanie A. Galloway

for Brian E. Holian, Director
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-331

Enclosure:
As stated

cc w/encl: Distribution via Listserv

Safety Evaluation Report

Related to the License Renewal of Duane Arnold Energy Center

Docket No. 50-331

FPL Energy Duane Arnold, LLC

United States Nuclear Regulatory Commission

Office of Nuclear Reactor Regulation

September 2010

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ABSTRACT

This safety evaluation report (SER) documents the technical review of the Duane Arnold Energy Center (DAEC) license renewal application (LRA) by the United States (US) Nuclear Regulatory Commission (NRC) staff (the staff). By letter dated September 30, 2008, FPL Energy Duane Arnold, LLC (FPL 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.” FPL requests renewal of the Duane Arnold Energy Center operating license (Facility Operating License Numbers DPR-49 respectively) for a period of 20 years beyond the current expiration at midnight February 21, 2014.

DAEC is located approximately 8 miles northwest of Cedar Rapids, IA. The NRC issued the construction permit for DAEC on June 22, 1970. The NRC issued the operating license for DAEC on November 22, 1974. General Electric supplied the Mark 1 BWR design nuclear steam supply system and Bechtel Power Corporation originally designed and constructed the balance of the plant. The licensed power output is 1912 megawatt thermal with a gross electrical output of approximately 629 megawatt electric.

This SER presents the status of the staff’s review of information submitted through April 28, 2010, the cutoff date for consideration in the SER. On May 7, 2010, the staff issued a draft SER which identified two open items that had to be resolved before the staff could make a final determination on the application. The two open items have now been resolved. Section 1.5 summarizes these items and their resolutions. SER Section 6 provides the staff’s final conclusion on the review of the DAEC LRA that the requirements for license renewal have been met.

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ACRONYMS AND ABBREVIATIONS

AAI	applicant action item
AC	alternating current
ACI	American Concrete Institute
ACRS	Advisory Committee on Reactor Safeguards
ACSR	Aluminum Conductor Steel Reinforced
ADAMS	Agencywide Document Access and Management System
ADS	automatic depressurization system
AEM	aging effect/mechanism
AERM	aging effect requiring management
AFW	auxiliary feedwater
AHU	air handling unit
AISC	American Institute of Steel Construction
aka	also known as
AMP	aging management program
AMR	aging management review
ANSI	American National Standards Institute
APRM	average power range monitor
AR	action request
ARI	alternate rod injection/alternate rod insertion
ART	adjusted reference temperature
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
AST	alternate source term
ASTM	American Society for Testing and Materials
ATWS	anticipated transient without scram
AWS	American Welding Society

B-10	Boron-10
B4C	boron carbide
B&PV	boiler and pressure vessel
BTP	branch technical position
BTP APCSB	Branch Technical Position Auxiliary Power Conversion Systems Branch
BWR	boiling water reactor
BWROG	Boiling Water Reactor Owners Group
BWRVIA	Boiling Water Reactor Vessel and Internals Application
BWRVIP	Boiling Water Reactor Vessel and Internals Program
CASS	cast austenitic stainless steel
CB&I	Chicago Bridge and Iron Co.
CEA	control element assembly
CF	chemistry factor
CFR	*Code of Federal Regulations*
CI	confirmatory item
CIG	containment instrument gas
CIV	combined intermediate valve
CLB	current licensing basis
CM	condition monitoring
CMAA	Crane Manufacturers Association of America
CO_2	carbon dioxide
CP	condensate pot
CPVC	chlorinated polyvinyl chloride
CPX	component maintenance system
CR	condition report
CRD	control rod drive
CRDH	control rod drive hydraulics
CRDHS	control rod drive hydraulic system
CRD-HSR	control rod drive hydraulic system return

CRDM	control rod drive mechanism
CREOASS	control room emergency outside air supply system
CRGT	contol rod guide tube
CS	carbon steel
CSS	core support structures
CSCW	control structure chilled water
CST	condensate storage tank
CWST	clarified water storage tank
CUF	cumulative usage factor
DAR	design assessment report
DBA	design-basis accident
DBD	design-basis document
DBE	design-basis event
DC	direct current
DG	diesel generator
DOR	Division of Operating Reactors
DOT	Department of Transportation
DP	differential pressure
EAF	environmentally assisted fatigue
ECCS	emergency core cooling system
ECP	electrochemical potential
EDG	emergency diesel generator
EFPY	effective full-power year
EHL	emergency heat load
EMA	equivalent margins analysis
EOL	end of life
EPA	electrical penetration assembly
EPRI	Electric Power Research Institute

EPRI-MRP	Electric Power Research Institute Materials Reliability Program
EPU	extended power uprate
EQ	environmental qualification
ESF	engineered safety feature
ESS	engineered safeguard system
ESSW	engineered safeguards service water
ESW	emergency service water
EVT	enhanced visual testing
F_{en}	environmental fatigue life correction factor
FEM	finite element analysis
FERC	Federal Energy Regulatory Commission
FPCCU	fuel pool cooling and cleanup system
FPL-DA	Florida Power and Light Energy Duane Arnold, LLC
FPRR	fire protection review report
FR	*Federal Register*
FW	feedwater
GALL	Generic Aging Lessons Learned Report
GDC	general design criteria or general design criterion
GE	General Electric
GEIS	generic environmental impact statement
GL	generic letter
gph	gallons per hour
GRRCCW	gaseous radwaste recombiner closed cooling water system
GSI	generic safety issue
GSW	general service water
HAZ	heat-affected zone
HCI	hydraulic control unit
HELB	high-energy line break

HEPA	high efficiency particulate air
HP	high pressure
HPCI	high pressure coolant injection
HPSI	high-pressure safety injection
HVAC	heating, ventilation, and air conditioning
HWC	hydrogen water chemistry
HX	heat exchanger
I&C	instrumentation and controls
I&E	inspection and flaw evaluation
IASCC	irradiation-assisted stress corrosion cracking
IBA	intermediate break accident
ICTM	isolated condenser treatment method
ID	inside diameter
IEEE	Institute of Electrical and Electronics Engineers
IGA	intergranular attack
IGSCC	intergranular stress corrosion cracking
IN	information notice
INPO	Institute of Nuclear Power Operations
IP	intermediate pressure
IPA	integrated plant assessment
IPE	individual plant evaluation
IPEEE	individual plant evaluation of external events
IR	insulation resistance
IRM	intermediate range monitor
ISFSI	independent spent fuel storage installation
ISG	interim staff guidance
ISI	inservice inspection
ISO	independent system operator
ISP	Integrated Surveillance Program

IWF	industrial waste filtration
Ksi	thousands of pounds per square inch
kV	kilovolt
LER	licensee event report
LLRWHF	low level radwaste holding facility
LOCA	loss-of-coolant accident
LP	low pressure
LPCI	low pressure coolant injection
LPCS	low pressure core spray
LPRM	local power range monitor
LR	license renewal
LRA	license renewal application
LTOP	low-temperature overpressure protection
MCM	thousands of circular mils
MEB	metal-enclosed bus
MeV	million electron volts
MIC	microbiologically-influenced corrosion
MOAB	motor operated air break
MRDB	maintenance rule database
MS	main steam
MSIV	main steam isolation valve
MSIV/LCS	main steam isolation valve/leakage control system
MT	magnetic testing
MWt	megawatts-thermal
MWe	megawatts-electric
N/A	not applicable
n/cm^2	neutrons per square centimeter

NCR	nonconformance report
NDE	nondestructive examination
NEI	Nuclear Energy Institute
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
Ni	nickel
NIMS	Nuclear Information Management System
NLDAE	new loads design adequacy evaluation
NMCA	noble metal chemical addition
NMAC	Nuclear Maintenance Assistance Center
NMS	neutron monitoring system
NOC	normal operating condition
NOS	nuclear oversight
NPD	nominal pipe diameter
NPS	nominal pipe size
NRC	U.S. Nuclear Regulatory Commission
NSAC	Nuclear Safety Analysis Center
NSAS	nonsafety affecting safety
NSE	nuclear system engineering
NSSS	nuclear steam supply system
NUMARC	Nuclear Management and Resources Council
NWC	normal water chemistry
ODCM	offsite dose calculation manual
ODSCC	outside-diameter stress corrosion cracking
OE	operating experience
OI	open item
OL	operating license
OQA	operational quality assurance

P&ID	piping and instrumentation diagrams
PaR	programmed and remote
PASS	post-accident sampling system
PDI	Performance Demonstration Initiatives
PGCC	Power Generation Control Complex
pH	concentration of hydrogen ions
PM	preventive maintenance/performance monitoring
PoF	probability of failure
ppb	parts per billion
ppm	parts per million
PPT	pre-planned task
psf	pounds per square foot
psig	pounds per square inch, gauge
P-T	pressure-temperature
PTS	pressurized thermal shock
PUAR	plant-unique analysis report
PVC	polyvinyl chloride
PWR	pressurized water reactor
PWSCC	primary water stress corrosion cracking
QA	quality assurance
QAP	quality assurance program
QAPD	quality assurance program description
RAAI	renewal applicant action item
RAI	request for additional information
RB	reactor building
RBCCW	reactor building closed cooling water
RBCW	reactor building chilled water
RBM	rod block monitor

RCCA	rod cluster control assembly
RCIC	reactor core isolation cooling
RCPB	reactor coolant pressure boundary
RCS	reactor coolant system
RCSPB	reactor coolant system pressure boundary
RFP	reactor feedwater pump
RFO	refueling outage
RG	regulatory guide
RHR	residual heat removal
RHRSW	residual heat removal service water
RI	reactor internals
RI-ISI	risk-informed inservice inspection
RIS	regulatory issue summary
RPT	recirculation pump trip
RPV	reactor pressure vessel
RR	reactor recirculation
RT	radiographic testing
RT_{NDT}	reference nil-ductility temperature
RVI	reactor vessel internal
RVID	reactor vessel integrity database
RWCU	reactor water cleanup
RWST	refueling water storage tank
SBA	small break accident
SBDG	standby diesel generator
SBO	station blackout
SC	structure and component
SCC	stress corrosion cracking
SCCM	standard cubic centimeter per minute
SCF	stress concentration factor

scfm	standard cubic foot/feet per minute
SCW	source of cooling water
SDV	scram discharge volume
SE	safety evaluation
SER	safety evaluation report
SGTS	standby gas treatment system
SJAE	steam jet air ejector
SLC	standby liquid control
SO^2	sulfur dioxide
SOC	statement of consideration
SOER	significant operating experience report
SOMS	shift operations management system
SPE	steam packing exhauster
SRM	source range monitoring
SRP	Standard Review Plan
SRP-LR	Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants
SRV	safety relief valve
SS	stainless steel
SSC	system, structure, and component
SSE	safe-shutdown earthquake
STP	surveillance test procedure
SW	service water
TAF	top of active fuel
TAP	torus attached piping
TBCCW	turbine building closed cooling water
TEMA	Tubular Exchanger Manufacturers Association
TIP	traversing incore probe
TLAA	time-limited aging analysis
TRM	technical requirements manual

TS	technical specifications
U.S.	United States
UFSAR	updated final safety analysis report
USAS	United States of America Standards
USE	upper-shelf energy
UT	ultrasonic testing
UV	ultraviolet
VDC	volts direct current
VFLD	vessel flange leak detection
VHP	reactor vessel head penetration
VT	visual testing
XLPE	cross-linked polyethylene
XLPO	cross-linked polyolefin
WA	work authorization
w/c ratio	water-to-cement ratio
Zn	zinc

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SECTION 1

INTRODUCTION AND GENERAL DISCUSSION

1.1 Introduction

This document is a safety evaluation report (SER) on the license renewal application (LRA) for Duane Arnold Energy Center (DAEC), as filed by the Florida Power and Light Energy Duane Arnold, LLC (FPL-DA or the applicant). By letter dated September 30, 2008, DAEC submitted its application to the U.S. Nuclear Regulatory Commission (NRC) for renewal of the DAEC operating licenses for an additional 20 years. The NRC staff (the staff) prepared this report to summarize the results of its safety review of the license renewal application (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 Brian K. Harris. Mr. Harris may be contacted by telephone at 301-415-2277 or by electronic mail at Brian.Harris2@nrc.gov. Alternatively, written correspondence may be sent to the following address:

Division of License Renewal
US Nuclear Regulatory Commission
Washington, DC 20555-0001
Attention: Brian K. Harris Mail Stop 011-F1

By letter dated September 30, 2008, as supplemented by letter dated January 23, 2009, FPL-DA submitted an application pursuant to 10 CFR Part 54 for renewal of Operating License DPR-49 for DAEC for a period of 20 years beyond the current expiration at midnight February 21, 2014. The DAEC plant site is adjacent to the Cedar River, approximately 2.5 miles northeast of Palo, Iowa. The site contains approximately 500 acres.

The nuclear steam supply system and the turbine-generator were furnished by the General Electric Company. The balance of the plant was designed and constructed by Bechtel Power Corporation as architect-engineer and constructor. The plant is licensed to operate at a core power level of 1,912 megawatts-thermal (MWt), approximately 629 megawatts-electric (MWe). DAEC was originally licensed to a core power level of 1,658 MWt. However, the plant technical specifications (TSs) restricted operation to 1,593 MWt. In 1985, commencing with reload cycle 8, the TSs were amended to allow operation at the licensed rated thermal power. Two power uprates have been approved since the initial core thermal power was licensed. In 1985, License Amendment 115 increased the licensed core thermal power to 1,658 MWt and in 2001, License Amendment 243 increased the licensed core thermal power to 1,912 MWt. The updated final safety analysis report (UFSAR) shows details of the plant and the site.

The license renewal process consists of two concurrent reviews, a technical review of safety issues and an environmental review. The NRC regulations in 10 CFR Part 54 and 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," respectively, set forth requirements for these reviews. The safety review for the DAEC license renewal is based on the applicant's LRA and on its responses to the staff's requests for additional information (RAIs). The applicant supplemented the LRA and provided clarifications through its responses to the staff's RAIs in audits, meetings, and docketed correspondence. Unless otherwise noted, the staff reviewed and considered information submitted through April 28, 2010. The staff reviewed information received after that date depending on the stage of the safety review and the volume and complexity of the information. The public may view the LRA and all pertinent information and materials, including the UFSAR, at the NRC Public Document Room, located on the first floor of One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852-2738 (301-415-4737/800-397-4209), and at the Hiawatha Public Library, 150 West Willman Street, Hiwatha, Iowa 52233. In addition, the public may find the LRA, as well as materials related to the license renewal review, on the NRC website at http://www.nrc.gov.

This SER summarizes the results of the staff's safety review of the LRA and describes the technical details considered in evaluating the safety aspects of the unit's proposed operation for an additional 20 years beyond the term of the current operating license. The staff reviewed the LRA in accordance with NRC regulations and the guidance in NUREG-1800, Revision 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 renewals for DAEC. The staff issued draft, plant-specific Generic Environmental Impact Statement (GEIS) 42, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Regarding Duane Arnold Energy Center, Draft Report for Comment," in February of 2010. The final, plant-specific GEIS Supplement 42, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Regarding Duane Arnold Energy Center," will be issued on October 15, 2010.

1.2 License Renewal Background

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

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

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

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

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 NRC regulations for fire protection, environmental qualification (EQ), pressurized thermal shock (PTS), anticipated transient without scram (ATWS), and station blackout (SBO).

Pursuant to 10 CFR 54.21(a), a license renewal applicant must review all SSCs within the scope of 10 CFR Part 54 to identify SCs subject to an aging management review (AMR). Those SCs subject to an AMR perform an intended function without moving parts or without change in configuration or properties and are not subject to replacement based on a qualified life or specified time period. Pursuant to 10 CFR 54.21(a), a license renewal applicant must demonstrate that the aging effects will be managed such that the intended 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.

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

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

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

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

In accordance with the National Environmental Policy Act of 1969 and 10 CFR Part 51, the staff reviewed the plant-specific environmental impacts of license renewal, including whether there was new and significant information not considered in the GEIS. As part of its scoping process, the staff held a public meeting on April 22, 2009, in the Hiawatha City Hall, Hiawatha, Iowa, to identify plant-specific environmental issues. The draft, plant-specific GEIS Supplement 42 documents the results of the environmental review and makes a preliminary recommendation as to the license renewal action. The staff held another public meeting on March 31, 2010, in Hiawatha City Hall, Hiawatha, Iowa, to discuss draft, plant-specific GEIS Supplement 42. After considering comments on the draft, the staff will publish the final, plant-specific GEIS Supplement 42 separately from this report.

1.3 Principal Review Matters

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

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

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

> The requirements of 10 CFR 54.19(b) state that license renewal applications include, "…conforming changes to the standard indemnity agreement, 10 CFR 140.92, Appendix B, to account for the expiration term of the proposed renewed license." The current indemnity agreement, No. B-68 for the Duane Arnold Energy Center, states that the agreement shall terminate at the time of expiration of the license. The indemnity agreement lists DPR-49 as the applicable license number. Should the license number be changed upon issuance of the renewed license, FPL Energy Duane Arnold requests that conforming changes be made to the indemnity agreement as appropriate.

Pursuant to 10 CFR 54.21, "Contents of Application – Technical Information," the NRC requires that the LRA contain:

(a) an integrated plant assessment
(b) a description of any CLB changes during the staff's review of the LRA
(c) an evaluation of TLAAs
(d) a UFSAR supplement

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

Pursuant to 10 CFR 54.21(b), the NRC requires that, each year following submission of the LRA and at least three months before the scheduled completion of the staff's review, the applicant submit an LRA amendment identifying any CLB changes to the facility that affect the contents of the LRA, including the UFSAR supplement. By letter September 30, 2009, the applicant submitted an LRA update which summarizes the CLB changes that have occurred during the staff's review of the LRA. This submission satisfies 10 CFR 54.21(b) requirements and is still under staff review.

Pursuant to 10 CFR 54.22, "Contents of Application – Technical Specifications," the NRC requires that the LRA include changes or additions to the 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 DAEC operating licenses. This statement adequately addresses the 10 CFR 54.22 requirement.

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

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

1.4 Interim Staff Guidance

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

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

Table 1.4-1 Current Interim Staff Guidance

ISG Issue (Approved ISG Number)	Purpose	SER Section
Nickel-alloy components in the reactor coolant pressure boundary (LR-ISG-19B)	Cracking of nickel-alloy components in the reactor pressure boundary. ISG under development. NEI and EPRI-MRP will develop an augmented inspection program for GALL AMP XI.M11-B. This AMP will not be completed until the NRC approves an augmented inspection program for nickel-alloy base metal components and welds as proposed by EPRI-MRP.	Not applicable (PWRs only)
Corrosion of drywell shell in Mark I containments (LR-ISG-2006-01)	To address concerns related to corrosion of drywell shell in Mark I containments.	3.5.2.2.1
Staff Guidance Regarding the Station Blackout Rule (10 CFR 50.63) Associated with License Renewal Applications (LR-ISG-2008-01)	To clarify the scoping boundary of the offsite recovery paths that must be included within the scope of license renewal for station blackout. The staff issued the proposed ISG for public comments. On July 7, 2009, the staff withdrew LR-ISG-2008-01. See 74 FR 33478, dated July 13, 2009.	2.5.1.2
Changes to Generic Aging Lesson Learned (GALL) Report Aging Management Program (AMP) XI.E6, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements" (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. The staff has addressed industry comments and a notice of availability of the Final LR-ISG-2007-02 was published in the *Federal Register* . See 74 FR 68287, dated December 23, 2009	3.0.3.3.1

1.5 Summary of Open Items

On May 7, 2010, the staff issued the SER with Open Items which identified the following open items (OIs). An item is considered open if, in the staff's judgment, it does not meet all applicable regulatory requirements at the time of the issuance of the SER. The staff has assigned a unique identifying number to each OI. As a result of additional responses by the applicant since the issuance of the SER with open items, the staff was able to resolve the OIs and complete its review.

OI-3.0.3.1.7 Buried Piping and Tanks Inspection Program

In LRA Section B.3.7, the applicant summarizes operating experience related to the Buried Piping and Tanks Inspection Program. The applicant stated that the program is new and, therefore, there has been no plant-specific program operating experience. The applicant also stated that industry operating experience will be evaluated in the development and implementation of this program and as additional operating experience is obtained, lessons learned will be appropriately incorporated into the program.

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

Given that there have been a number of recent industry events involving leakage from buried or underground piping, the staff needed further information to evaluate the impact that these recent industry events might have on the applicant's Buried Piping and Tanks Inspection Program. By letter dated May 3, 2010, the staff issued RAI B.3.7-1-X requesting that the applicant provide information regarding how DAEC will incorporate the recent industry OE into its aging management reviews and programs.

In its response dated May 28, 2010, as supplemented on July 29, 2010, and August 18, 2010, the applicant provided additional information to describe how it incorporated operating experience into its Buried Piping and Tanks Inspection Program. Open item OI- 3.0.3.1.7 is resolved.

<u>OI-3.0.3.3.3</u> Small Bore Piping Program

In LRA Section B.3.40, the applicant states that the ASME Code Class 1 Small Bore Piping Inspection Program will perform volumetric examination on the subject butt welds. However, the applicant stated that for socket welds, the program will only perform a visual inspection (VT-2) for the subject socket welds.

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 and for a condition monitoring program, the parameter monitored or inspected should detect the presence and extent of aging effects.

The staff noted that for the subject butt welds, the use of volumetric, surface, and visual inspections will be performed on a periodic basis such that degradation, such as cracking and leakage, is monitored and inspected.

The staff also noted that, for the subject socket welds, only VT-2 visual inspections will be performed which is only for leakage detection. Since cracking in socket welds starts mostly from the inside surface, by the time a leak is detected by VT-2, the subject component would have already failed and lost its intended function. This is the reason GALL AMP XI.M.35 recommends volumetric examinations of small bore piping including socket welds. During a teleconference call on December 14, 2009, the staff informed the applicant that it does not consider visual examination adequate for aging management in small bore socket welds as that is not consistent with the GALL Report recommendations.

By letter dated February 22, 2010, the staff issued RAI B.3.40-2 to indicate that the applicant’s program was not consistent with the recommendation of GALL AMP XI.M.35, and requested the applicant to address examination of socket welds in a manner consistent with the GALL report recommendations. By letter dated March 9, 2010, and as supplemented by letter dated April 28, 2010, the applicant provided its response to the staff’s RAI. In its response, the applicant stated that most of the failures in its operating experience review were due to high cycle fatigue, in which a crack propagates so fast that inspection/volumetric examination would not be useful for detection. The staff disagrees with the applicant’s statement, however, and notes that various UT examination techniques are available for detection of flaws caused by high cycle fatigue. The applicant also stated that VT-2 is considered to be a reasonable part of an AMP, and it is the only practical inspection methodology available today, since there is no qualified volumetric inspection method available for socket welds. The staff noted that various UT procedures have been developed to examine socket welds. Although not specifically qualified for sizing, such efforts can nonetheless provide go/no-go results that are useful in detecting flaws. While the staff understands the applicant’s statement that there is no industry-wide “qualified” volumetric standard for socket welds, the staff does not agree that in lack of such a “qualified” standard, VT-2 is sufficient in meeting the intent of the GALL AMP XI.M35. Where the GALL AMP states that the volumetric technique “needs to be qualified,” the staff does not interpret it as a PDI (performance demonstration initiatives) qualified procedure but expects that the applicant should provide some demonstrated technique that is capable of detecting the flaws of relevant size and character for socket welds. The volumetric technique, as discussed in the GALL Report, is not intended to preclude applicants from using alternate techniques that may be available, but rather to detect early signs of failure. In its April 28, 2010, response regarding this issue, the applicant has indicated that it may perform volumetric inspections only “if an acceptable nuclear industry methodology for performing volumetric examinations of socket weld fittings is developed.” Such a statement does not provide the staff assurance that the recommendations of GALL AMP XI.M35 are followed to manage the aging effects of socket welds at DAEC.

By letter dated May 28, 2010, the applicant provided a supplemental response to the RAI B.3.40-2 to address the staff’s concern. Open item OI-3.0.3.3.3 is resolved.

1.6 <u>Summary of Proposed License Conditions</u>

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

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

The second license condition requires future activities described in the UFSAR supplement to be completed prior to the period of extended operation excluding commitments 2, 3, 50, and 51, which will be completed during the period of extended operation.

The third license condition requires the implementation of the most recent staff-approved version of the Boiling Water Reactor Vessels and Internals Project (BWRVIP) Integrated Surveillance Program (ISP) as the method to demonstrate compliance with the requirements of 10 CFR Part 50, Appendix H. Any changes to the BWRVIP ISP capsule withdrawal schedule must be submitted for staff review and approval. Any changes to the BWRVIP ISP capsule withdrawal schedule which affects the time of withdrawal of any surveillance capsules must be incorporated into the licensing basis. If any surveillance capsules are removed without the intent to test them, these capsules must be stored in a manner which maintains them in a condition which would support re-insertion into the reactor pressure vessel if necessary.

SECTION 2

STRUCTURES AND COMPONENTS SUBJECT TO AGING MANAGEMENT REVIEW

2.1 Scoping and Screening Methodology

2.1.1 Introduction

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

LRA Section 2.1, "Scoping and Screening Methodology," describes the scoping and screening methodology used to identify the SSCs at the Duane Arnold Energy Center (DAEC) within the scope of license renewal, as well as the SCs subject to an AMR. The staff reviewed the scoping and screening methodology of the FPL Energy Duane Arnold, LLC, (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 the Rule, and the guidance of Nuclear Energy Institute (NEI) 95-10, Revision 6, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54, The License Renewal Rule," dated June 2005 (NEI 95-10). Additionally, in developing this methodology, the applicant stated that it considered the correspondence between the U.S. Nuclear Regulatory Commission (NRC), other applicants, and NEI.

2.1.2 Summary of Technical Information in the Application

LRA Sections 2 and 3 describe the technical information required by 10 CFR 54.4, "Scope," and 10 CFR 54.21(a). This safety evaluation report (SER), contains sections entitled "Summary of Technical Information in the Application," which provides information taken directly from the LRA.

LRA Section 2.1 describes the process used to identify the SSCs that meet the license renewal scoping criteria under 10 CFR 54.4(a), and the process used to identify the SCs that are subject to an AMR, as required by 10 CFR 54.21(a)(1). The applicant provided the results of the process used for identifying the SCs subject to an AMR in the following LRA Sections:

(a) LRA Section 2.2, "Plant Level Scoping Results"

(b) LRA Section 2.3, "Scoping and Screening Results: Mechanical Systems"

(c) LRA Section 2.4, “Scoping and Screening Results: Structures and Structural Components”

(d) LRA Section 2.5, “Scoping and Screening Results: Electrical/Instrumentation and Controls (I&C) Systems”

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

(a) LRA Section 3.1, “Aging Management of Reactor Coolant Systems”

(b) LRA Section 3.2, “Aging Management of Engineered Safety Features”

(c) LRA Section 3.3, “Aging Management of Auxiliary Systems”

(d) LRA Section 3.4, “Aging Management of Steam and Power Conversion Systems”

(e) LRA Section 3.5, “Aging Management of Containment, Structures and Structural Components”

(f) LRA Section 3.6, “Aging Management of Electrical and Instrumentation and Controls Systems”

(g) LRA Section 4.0, “Time-Limited Aging Analyses,” contains the applicant’s identification and evaluation of TLAAs”

2.1.3 Scoping and Screening Program Review

The staff evaluated the LRA scoping and screening methodology in accordance with the guidance contained in 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 the requirements of 10 CFR 54.4(a)

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

In addition, the staff conducted a scoping and screening methodology audit at DAEC, located in Palo, Iowa, during the week of August 24-28, 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 qualification of the LRA development team.

The staff evaluated the quality attributes of the applicant’s aging management program (AMP) activities described in Appendix A, “Duane Arnold UFSAR Supplement,” and Appendix B, “Aging Management Programs and Activities,” of the LRA. On a sampling basis, the staff performed a system review of the safety-related air, residual heat removal, emergency service water, 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 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 November 2, 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 applicant’s commitments, as documented in the CLB and relative to the requirements of 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 final safety analysis report (UFSAR)

- DAEC quality classifications

- plant equipment database
- controlled drawings
- controlled databases
- industry codes, standards, and regulations
- NRC docketed correspondence and documents
- technical correspondence, analyses, and reports
- calculations
- design-basis documents (DBDs)
- plant modifications and alterations
- nuclear steam supply system supplier, architect-engineer, vendor reports, specifications, and drawings

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 NRC staff positions documented in the SRP-LR, and the information in the applicant's responses, dated December 2, 2009, to the staff's requests for additional information (RAIs), dated November 2, 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 requiring an AMR. Pursuant to 10 CFR 54.3(a), the CLB is the set of NRC requirements applicable to a specific plant and an applicant's written commitments for ensuring compliance with, and operation within, applicable NRC requirements and the plant-specific design bases that are docketed and in effect. The

CLB includes applicable NRC regulations, orders, license conditions, exemptions, technical specifications, and design-basis information (documented in the most recent UFSAR). The CLB also includes applicant commitments remaining in effect that were made in docketed licensing correspondence, such as applicant responses to NRC bulletins, generic letters, and enforcement actions, and applicant commitments documented in NRC safety evaluations or applicant event reports.

During the audit, the staff reviewed pertinent information resources used by the applicant including the UFSAR, DBDs, 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, the plant equipment database, quality classifications, controlled drawings, and technical correspondence, analyses and reports. The staff confirmed that the applicant's detailed license renewal program guidelines specified the use of the CLB-source information in developing scoping evaluations.

The plant equipment data base, UFSAR, quality classifications, and DBDs 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 plant equipment data base, DBDs, 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 DAEC documentation, the NRC staff concludes that the applicant has established adequate measures to control the integrity and reliability of DAEC system identification and safety classification data and, therefore, the staff concludes that the information sources used by DAEC 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 pursuant to 10 CFR 54.4(a). The applicant's license renewal program guidelines provided a listing of documents used to support scoping and screening evaluations. The staff finds these design documentation sources to be useful for ensuring that the initial scope of SSCs identified by the applicant was consistent with the plant's CLB.

2.1.3.1.3 Conclusion

Based on its review of LRA Section 2.1, the 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 LRA Development

2.1.3.2.1 Staff Evaluation

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

- Written procedures were developed to govern the implementation of the scoping and screening methodology.
- Basis documents were prepared for each system that provided descriptions of system functions, system function references, equipment within the boundary, and components subject to an AMR.
- Scoping and screening summary reports and revisions were prepared, independently verified, and approved.
- All project deliverables included a preparer, verifier, technical lead, project lead, and the program owner when appropriate.
- Lessons learned from prior license renewal applications were incorporated into the application.
- Documents received an industry peer review.
- A sample of systems in the license renewal database was reviewed by an independent evaluator to verify that systems scoping had been documented appropriately.
- Two oversight evaluations were performed to review the license renewal activities and concluded that license renewal activities were satisfactory.
- Staff involved in the license renewal process participated in NEI sponsored industry groups.
- Management oversight was provided in monthly meetings to review the status of projects and issues.

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. As outlined in the implementing procedures, the applicant requires training for all personnel participating in the development of the LRA and uses only trained and qualified personnel to prepare the scoping and screening implementing procedures. The training included the following activities:

- A license renewal training program was developed following an industry training process to develop a Job Familiarization Guide (JFG) for license renewal.
- All license renewal team members were required to complete the appropriate JFG in accordance with station procedures and were assessed during an interview to verify an understanding of the material.
- The training material for JFG was detailed and covered the entire license renewal process as defined in the license renewal administrative control procedures.
- All license renewal team members were required to complete the JFG prior to signing a report.
- Certain work on the license renewal projects required staff to be qualified in additional qualification programs.
- The training process incorporated lessons-learned from other license renewal projects.
- The Electric Power Research Institute (EPRI) provided two training sessions on recognizing aging effects.

The staff reviewed the applicant's written procedures and, on a sampling basis, reviewed completed qualification and training records and completed check lists for some of the applicant's license renewal personnel. The staff 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 Conclusion of Scoping and Screening Program Review

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

2.1.4 Plant Systems, Structures, and Components Scoping Methodology

LRA Section 2.1 described the applicant's methodology used to scope SSCs pursuant to the requirements of the 10 CFR 54.4(a) criteria. The LRA states that the scoping process categorized the entire plant in terms of major systems and structures with respect to license renewal. According to the LRA, major systems and structures were evaluated against criteria provided in 10 CFR Part 54.4(a)(1), (2), and (3) to determine whether or not the item should be considered within the scope of license renewal. The LRA states that that the scoping process identified the SSCs that are safety-related and perform or support an intended function for responding to a design-basis event; are nonsafety-related but their failure could prevent accomplishment of a safety-related function; or support a specific requirement for one of the five regulated events applicable to license renewal. LRA 2.1.1.1, "License Renewal Database," stated that the scoping methodology used by DAEC is consistent with 10 CFR 54.4 and with the industry guidance contained in NEI 95-10.

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 2.1.2.2.1, Safety-Related Pursuant to 10 CFR 54.4(a)(1), states:

> 10 CFR 54.4(a)(1) requires that plant SSCs that are relied upon to remain functional during and following design-basis events (as defined in 10 CFR 50.49 (b)(1)) to ensure the following functions:
>
> (i) The integrity of the reactor coolant pressure boundary
>
> (ii) The capability to shut down the reactor and maintain it in a safe shutdown condition
>
> (iii) The capability to prevent or mitigate the consequences of accidents which could result in potential off-site exposures comparable to those referred to in 10 CFR 50.34(a)(1),10 CFR 50.67(b)(2), or 10 CFR 100.11, as applicable
>
> This is the current NRC definition of "safety-related." In recent years this, or very similar wording, has been introduced in NRC regulations and guidance

> documents. The design, construction, and licensing of Duane Arnold predates this definition of safety-related.
>
> The Duane Arnold Quality Levels were used to code items as safety-related in the Duane Arnold plant equipment database. The Duane Arnold plant equipment database served as one of the information sources used to identify systems, structures, and components required by § 54.4(a)(1). The component functions were identified using a number of information sources, including the CLB. These functions were compared to § 54.4(a)(1) to identify those that are in-scope for license renewal for Duane Arnold design basis events, regardless of their current classification in the plant equipment database or supporting Quality Level information sources. In addition to the plant equipment database, the Duane Arnold P&IDs [piping and instrumentation diagrams] and other controlled drawings were used to identify components required to support in-scope system-level and structure-level functions.

Therefore, the SSCs which perform any of the functions identified in § 54.4(a)(1) for Duane Arnold DBEs have been included in the scope of license renewal and the identification of these components and commodities was based on a variety of information sources.

2.1.4.1.2 Staff Evaluation

Pursuant to 10 CFR 54.4(a)(1), the applicant must consider all safety-related SSCs relied upon to remain functional during and following a DBE to ensure the following functions: (1) the integrity of the reactor coolant pressure boundary; (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, SRP-LR Section 2.1.3, “Review Procedures,” states:

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

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

The applicant performed scoping of SSCs for the 10 CFR 54.4(a)(1) criterion in accordance with the license renewal implementing procedures which 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 DAEC CLB definition Quality Level 1 met the definition of safety-related specified in the Rule. The staff reviewed a sample of the license renewal scoping results for the safety-related air, residual heat removal, emergency service water, and the turbine building to provide additional assurance that the applicant adequately implemented its scoping methodology with respect to 10 CFR 54.4(a)(1). The staff confirmed that the applicant developed the scoping results for each of the sampled systems consistently with the methodology, identified the SSCs credited for performing intended functions, and adequately described the basis for the results, as well as the intended functions. The staff also confirmed that the applicant had identified and used pertinent engineering and licensing information to identify the SSCs required to be within the scope of license renewal, in accordance with the 10 CFR 54.4(a)(1) criteria.

However, during the scoping and screening methodology audit performed onsite August 24–28, 2009, the staff determined that the applicant had not included some components, classified as safety-related in the equipment database, within the scope of license renewal in accordance with 10 CFR 54.4(a)(1). In RAI 2.1-1, dated November 2, 2009, the staff requested that the applicant perform a review of the issue and provide the basis for not including components, classified as safety-related in the equipment database, within the scope of license renewal in accordance with 10 CFR 54.4(a)(1). The staff also requested that the applicant describe any additional scoping evaluations to be performed to address the 10 CFR 54.4(a) criteria and, as part of the response, list any additional SSCs included within the scope as a result of such efforts, and list those SCs for which AMRs were conducted.

The applicant responded to RAI 2.1-1 by letter dated December 2, 2009, which stated the following:

> The license renewal database was populated with the component identification nomenclature and quality classification data that existed in the plant equipment data base. [The applicant] performed a review of the license renewal database to identify components which showed a safety-related classification, as downloaded from the plant equipment database, but were not processed in the license renewal database as being in the scope of license renewal for 10 CFR 54.4(a)(1). With three exceptions, as discussed below, the review determined that the safety-related components had been processed correctly in the license renewal database.

In addition, the applicant's response to RAI 2.1-1 stated that components identified as safety-related in the plant equipment database, but which were not included within the scope of license renewal in accordance with 10 CFR 54.4(a)(1), had been evaluated as follows:

- Components had been further divided into subcomponents. The individual subcomponents were evaluated as being within the scope of license renewal and subject to an AMR
- Subcomponents that were part of a larger component. The larger component was evaluated as being within the scope of license renewal and subject to an AMR
- Components were treated as part of a commodity group. The commodity group was evaluated as being within the scope of license renewal and subject to an AMR
- Components identified as safety-related in the plant equipment database but were determined to have no license renewal intended function meeting the requirements of 10 CFR 54.4(a) and which were not included within the scope of license renewal

Finally, the applicant's response to RAI 2.1-1 indicated that the review had identified components in three systems which were identified as safety-related in the plant equipment database, and which should have been included within the scope of license renewal and subject to an AMR, although this had not been accomplished. The applicant indicated that the appropriate AMR's had subsequently been performed. The additional components, determined to be within the scope of license renewal and subject to an AMR are as follows:

- B standby diesel generator and diesel oil system Thermowell TW3271B
- Reactor head spray isolation valve and operator MO 1900 and MO1900-0
- Containment atmospheric control system valves FCV4301A, FCV4303A, V43-0521, V43-0522, V43-0523, V43-0583, V43-0584, V43-0585, and V43-0610

The staff reviewed the applicant's response to RAI 2.1-1 and determined that the applicant had performed a review of the process used to determine whether components, identified as safety-related in the plant equipment database, were appropriately included within the scope of license renewal and evaluated to determine if the component was subject to an AMR. The staff determined that the applicant had provided an acceptable basis for not including components within the scope of license renewal when the components were evaluated as either part of a larger component, evaluated as a collection of subcomponents, or determined to not have any license renewal intended functions as listed in 10 CFR 54.4(a). In addition, the staff determined that the applicant, during the review performed in response to RAI 2.1-1, had identified three sets of components which should have been included within the scope of license renewal and been subject to an AMR, although this had not yet been accomplished, and that the applicant had subsequently performed the appropriate AMR's. The staff concluded that the applicant had provided an adequate basis for determining whether components, identified as safety-related in the plant equipment database, should be including within the scope of license renewal and subject to an AMR and the applicant had also performed a review which identified additional components in three system as within the scope of license renewal and subject to an AMR, and that the issue identified by RAI 2.1-1 is closed.

2.1.4.1.3 Conclusion

On the basis of its review of systems (on a sampling basis), discussions with the applicant, review of the applicant's scoping process, and review of the applicant's response to RAI 2.1-1, the staff concludes that the applicant's methodology for identifying systems and structures is consistent with the SRP-LR and 10 CFR 54.4(a)(1) and, therefore, is acceptable.

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

2.1.4.2.1 Summary of Technical Information in the Application

LRA Section 2.1.2.2.2, "Scoping Criterion 2 – Nonsafety-Related Affecting Safety-Related Pursuant to 10 CFR 54.4(a)(2)," states:

> Part 54.4(a)(2) of 10 CFR requires that all nonsafety-related systems, structures and components whose failure could prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a)(1) be included within the scope of license renewal. SSCs required by 10 CFR 54.4(a)(2) for DAEC are included in one of the following three categories:
>
> - Current Licensing Basis (CLB) Topics. The Duane Arnold Energy Center's CLB includes a number of topics that identify nonsafety-related SSCs credited for preventive or mitigative functions in support of safe shutdown for special events (e.g., external floods) or whose failure could prevent satisfactory accomplishment of a safety-related function (e.g., seismic interactions).
> - For the purpose of license renewal, nonsafety-related SSCs directly connected to safety-related SSCs (typically piping systems).
> - For the purpose of license renewal, nonsafety-related SSCs that are not directly connected to safety-related SSCs but whose failure could prevent the satisfactory accomplishment of a safety-related function due to spatial proximity.
>
> SSCs required by 10 CFR 54.4(a)(2) in the first two categories are typically identified during document reviews including the Duane Arnold Energy Center UFSAR, plant drawings, design documents, piping analyses, the plant equipment database, and other CLB documents. SSCs required by 10 CFR 54.4(a)(2) in the third category are typically identified by both document reviews and plant walkdowns to identify possible spatial interactions meeting the broader criteria established for license renewal.

LRA Section 2.1.2.2.2 states, in relation to nonsafety-related SSCs directly connected to safety-related SSCs:

- SSCs directly connected to safety-related SSCs. For nonsafety-related SSCs directly connected to safety-related SSCs, the in-scope boundary for license renewal extends into the nonsafety-related portion of the piping and supports up to and including the first equivalent anchor beyond the safety/nonsafety interface. For DAEC, the first equivalent anchor is that point beyond which failure of the piping system would not prevent the satisfactory accomplishment of the safety-related function of the connected SSCs. Examples given that constitute the first equivalent anchor include: a seismic anchor, a large piece of plant equipment, a building penetration, and two levels of support in each orthogonal direction. In general, equivalent anchors were selected consistent with the pipe analyses of record that demonstrate seismic adequacy of the various configurations. The piping components and supports up to and including the first equivalent anchor are in-scope for license renewal. This was consistent with the definition of seismic and equivalent anchors in NEI 95-10 Revision 6. Nonsafety-related structures attached to or next to safety-related structures are in-scope for license renewal if their failure could prevent a safety-related SSC from performing its intended function.

- Small bore lines attached to the safety-related portion of the large bore lines or safety-related equipment are typically safety-related to the first isolation valve and nonsafety-related thereafter. Most of these small bore lines are either drain or vent lines. In addition, many of these lines have no supports (i.e., cantilevers). For those instances, the entire line is in-scope for license renewal. The drain and vent lines that do have supports generally run to a nearby drain. The entire piping and supports are in-scope for license renewal. The applicant stated that, in some instances the small bore nonsafety-related piping has no seismic anchors. In those instances, the in-scope portion was extended "sufficiently far" from the safety-related portion such that the nonsafety-related piping beyond that point would not have a significant effect on the safety-related portion. The definition of "sufficiently far" is the same as for large bore piping (i.e., a minimum of two levels of support in each orthogonal direction). Small bore lines often transition into tubing. Due to the relative flexibility between the piping and tubing, the nonsafety-related tubing was considered to have a negligible impact on the piping. Therefore, the nonsafety-related affecting safety-related boundary for these lines is the tubing transition point. All tubing that is not air filled is in-scope for (a)(2) unless located in a room that does not contain safety-related components.

LRA Section 2.1.2.2.2 states, in relation to nonsafety-related SSCs that are in spatial proximity of safety-related SSCs:

> For nonsafety-related SSCs that are not directly connected to safety-related SSCs, the nonsafety-related SSCs are in-scope if their failure could prevent the performance of a safety-related function.
>
> - <u>Fluid or Steam Systems</u>. For fluid or steam systems that could affect safety-related SSCs due to spray and/or leaks, a list of safety-related components and commodities, and their location was assembled based on the plant equipment database. Nonsafety-related components with the potential to spray or leak which are located in close proximity to safety-related and/or safety significant SSCs were considered in-scope for license renewal. Close proximity was defined as being in the same room. As required, walkdowns were performed to identify nonsafety-related components that are located such that they could impact safety-related SSCs (spatial approach). For inaccessible areas during plant operation, a review was performed using mechanical, civil, and piping drawings to identify nonsafety-related components for their impact on safety-related SSCs.
>
> - <u>Air/Gas Systems</u>. Leakage of air/gas systems (non-liquid) are not a hazard to other plant equipment. For DAEC, a site-specific review was made of

operating experience in regards to air/gas systems which verified that DAEC air/gas systems have not negatively affected other plant equipment. Since none of the air/gas lines are considered high-energy lines and all supports in buildings with safety-related SSCs are in-scope for license renewal, air/gas systems are not required by criterion 10 CFR 54.4(a)(2).

- Nonsafety-Related Conduits, Trays, Junction Boxes, and Lighting Fixtures. Nonsafety-related conduits, cable trays, junction boxes, and lighting fixtures may be routed near safety-related SSCs. To determine which of these commodities to consider in-scope for license renewal, a conservative, simplified approach was used. All nonsafety-related conduit, tray, junction box and lighting fixture supports located within structures housing safety-related equipment are in-scope for license renewal.

- Nonsafety-Related Heating, Ventilation, and Air Conditioning Ducts and Supports. Though most heating, ventilation, and air conditioning ducts and their supports are nonsafety-related, they are located throughout the plant and typically run along ceilings and thus above many safety-related SSCs. Similar to air/gas pipe systems, leakage from heating, ventilation, and air conditioning ducts is not a hazard to other plant equipment. The only spatial interaction concern is falling. Similar to conduit and cable trays, a conservative, simplified approach was used. All heating, ventilation, and air conditioning ducts supports located within structures housing safety-related SSCs are in-scope for license renewal.

- Steam Dryer Assembly. Industry operating experience has shown that steam dryer assembly structural failures can occur. These structural failures have the potential to pass pieces down the main steam lines and potentially cause the main steam isolation valves (MSIVs) to fail to operate properly. These failures are directly attributable to implementation of an extended power uprate. In 1985, the thermal power of the plant was increased from 1593 MWt [megawatt thermal] to 1658 MWt. It was increased again in 2001 to its current license limit of 1912 MWt. DAEC has not experienced any steam dryer failures during the period of increased power operation and dryer failures in the industry have typically been attributed to design, not aging, concerns. During evaluation of the Dresden/Quad Cities Station license renewal application, the NRC recommended the steam dryers be considered pursuant to criterion § 54.4(a)(2). Consistent with this recommendation, the DAEC has included the steam dryer assembly as in-scope for license renewal.

- Seismic Interaction. Within the Duane Arnold CLB, some lines and structures designed to [American Society of Mechanical Engineers] ASME Class II seismic requirements were re-analyzed to more stringent requirements (seismic II/I) due to potential adverse interaction with safety-related SSCs. These lines (including supports) and structures are in-scope for license renewal.

- Main Steam Isolation Valve Leakage Treatment Path. The Main Steam Isolation Valve Leakage Treatment Path is designed to mitigate the release of fission products following a [loss-of-coolant accident] LOCA. This is accomplished by directing main steam isolation valve leakage to the main condenser via the main steam drain line manifold connected downstream of the outboard main steam isolation valves. The volume and surface area of the condenser provides holdup time and plate-out surface for fission products. There is a primary leakage path to the main condenser, as well as an alternate path in the event that motor operated valves in the primary path fail to open. Other steam systems connected to main steam are isolated to ensure that leakage is processed through this path. SSCs that support the leakage treatment path (e.g., reposition to establish a boundary) are in-scope for license renewal pursuant to criterion 10 CFR 54.4(a)(2).

2.1.4.2.2 Staff Evaluation

Pursuant to 10 CFR 54.4(a)(2), the applicant must consider all nonsafety-related SSCs, whose failure could prevent the satisfactory accomplishment of safety-related functions; and for SSCs relied on to remain functional during and following a DBE to ensure: (1) the integrity of the reactor coolant pressure boundary, (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.

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

In addition, the staff's position (as discussed in NEI 95-10, Revision 6) is that applicants should not consider hypothetical failures, but rather should base their evaluation on the plant's CLB, engineering judgment and analyses, and relevant operating experience. NEI 95-10 further describes operating experience as all documented plant-specific and industry-wide experience that can be used to determine the plausibility of a failure. Documentation would include NRC generic communications and event reports, plant-specific condition reports, industry reports such as safety operational event reports, and engineering evaluations. The staff reviewed LRA Section 2.1.2.2.2 in which the applicant described the scoping methodology for nonsafety-related SSCs pursuant to 10 CFR 54.4(a)(2). In addition, the staff reviewed the applicant's implementing document and results report, which documented the guidance and corresponding results of the applicant's scoping review pursuant to 10 CFR 54.4(a)(2). The applicant stated that it performed the review in accordance with the guidance contained in NEI 95-10, Revision 6, Appendix F.

<u>Nonsafety-Related SSCs Required to Perform a Function that Supports a Safety-Related SSC</u>. The staff determined that nonsafety-related SSCs required to remain functional to support a safety-related function had been reviewed by the applicant for inclusion within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2). The staff reviewed the evaluating criteria discussed in LRA Section 2.1.2.2.2 and the applicant's 10 CFR 54.4(a)(2) implementing document. The staff confirmed that the applicant had reviewed the UFSAR, plant drawings, plant equipment database, and other CLB documents to identify the nonsafety-related systems and structures that function to support a safety-related system whose failure could prevent the performance of a safety-related intended function. The applicant also considered missiles,

overhead handling systems, internal and external flooding, and HELBs. Accordingly, the staff finds that the applicant implemented an acceptable method for including nonsafety-related systems that perform functions that support safety-related intended functions, within the scope of license renewal as required by 10 CFR 54.4(a)(2).

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 2.1.2.2.2 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 a combination of the following to identify the portion of nonsafety-related piping systems to include within the scope of license renewal:

- seismic anchors
- equivalent anchors
- bounding conditions described in NEI 95-10 Revision 6, Appendix F (base-mounted component, flexible connection, or inclusion of the entire piping run)

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 Section 2.1.2.2.2 and the applicant’s 10 CFR 54.4(a)(2) implementing procedure. The applicant had considered physical impacts (eg., pipe whip, jet impingement) harsh environments, flooding, spray, and leakage when evaluating the potential for spatial interactions between nonsafety-related systems and safety-related SSCs. The staff further confirmed that the applicant used a spaces approach to identify the portions of nonsafety-related systems with the potential for spatial interaction with safety-related SSCs. The spaces approach focused on the interaction between nonsafety-related and safety-related SSCs that are located in the same space, which was defined for the purposes of the review, as a structure containing active or passive safety-related SSCs.

LRA Section 2.1.2.2.2 and the applicant’s implementing document state that the applicant had used mitigative features when considering the impact of nonsafety-related SSCs on safety-related SSCs for occurrences discussed in the CLB. The staff reviewed the applicant’s CLB information, primarily contained in the UFSAR, related to missiles, crane load drops, 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 applicant had also used a mitigative approach to exclude spaces that did not contain safety-related SSCs by including the mitigative features such as walls, floors, doors and dikes, and missile barriers, which would mitigate the interaction of spray, leakage, or flooding on safety-related SSCs located outside of the excluded space. 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).

LRA Section 2.1.2.2.2 and the applicant's implementing document state that the applicant had used a preventive approach, which considered the impact of nonsafety-related SSCs contained in the same space as safety-related SSCs. The staff determined that the applicant had evaluated all nonsafety-related SSCs, containing liquid or steam, and located in spaces containing safety-related SSCs. The applicant used a spaces approach to identify the nonsafety-related SSCs that were located within the same space as safety-related SSCs. As described in the LRA and for the purpose of the scoping review, a space was defined as a structure containing active or passive safety-related SSCs. In addition, the staff determined that following the identification of the applicable mechanical systems, the applicant identified its corresponding structures for potential spatial interaction, based on a review of the CLB and plant walkdowns. Nonsafety-related systems and components that contain liquid or steam and located inside structures that contain safety-related SSCs were included within the scope of license renewal, unless it was in an excluded space. The staff also determined that based on plant and industry operating experience, the applicant excluded the nonsafety-related SSCs containing air or gas from the scope of license renewal, with the exception of portions that are attached to safety-related SSCs and required for structural support. The staff confirmed that those nonsafety-related SSCs determined to contain liquid or steam and located within a space containing safety-related SSCs were included within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2).

The staff determined that additional information would be required to complete the review of the applicant's scoping methodology. RAI 2.1-2, dated November 2, 2009, states that during the scoping and screening methodology audit performed onsite August 24–28, 2009, the staff determined the following:

> (A) Certain nonsafety-related tubing, which is a portion of a nonsafety-related piping system attached to safety-related SSCs, had not been included within the scope of license renewal, and that the applicant indicated that the interface between the pipe and the tubing identified the boundary of the nonsafety-related component to be included within the scope of license renewal (the pipe was included while the tubing was not). The staff requested that the applicant perform a review of the issue and provide the basis for not including certain nonsafety-related tubing, which is a portion of a nonsafety-related piping system attached to safety-related SSCs, within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).
>
> (B) The staff determined that the nonsafety-related intake structure trash bars and trash rake IS-83, located adjacent or within the safety-related intake structure, had not been included within the scope of license renewal. The staff requested that the applicant perform a review of the issue and provide the basis for not including the intake structure trash bars and trash rake IS-83, located adjacent or within the safety-related intake structure and traveling screens, within the scope of license renewal in accordance with 10 CFR 54.4(a)(2).

The applicant responded to RAI 2.1-2(A) by letter dated December 2, 2009, which states the following:

> Concerning nonsafety-related small bore lines that transition into tubing, if the tubing contains liquid, it is included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2) unless it is located in a room which does not contain safety-related SSCs.
>
> If nonsafety-related tubing, connected to safety-related SSCs, does not contain liquid, it is not included within the scope of license renewal. The basis for not including the nonsafety-related tubing is that the moment of inertia ratio of the piping to the tubing is equal to or greater than the acceptable ratio, as defined in the current licensing basis [CLB], at which the tubing does not impose loads on either the larger piping or the piping supports.

The staff determined that the applicant had appropriately included fluid-filled nonsafety-related tubing, attached to safety related pipe and in the proximity of safety-related SSCs, within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2). The staff also determined that the applicant had used CLB information to determine that nonfluid-filled, nonsafety-related tubing could not impose sufficient loads on safety-related piping to prevent the accomplishment of a safety-related 10 CFR 54.4(a)(1) intended function and, therefore, was not required to be included within the scope of license renewal. Therefore, the staff's concern described in RAI 2.1-2(A) is resolved.

The applicant responded to RAI 2.1-2 (B) by letter dated December 2, 2009, which states the following:

> The river water intake structure trash bars are located outboard of the travelling screens and provide a nonsafety-related function to minimize the potential for large debris to enter the travelling screen bays. The low river water velocity ensures that any parts that might be postulated to fail and detach from the intake structure trash bars would only fall vertically to the river bed or the floor of the intake structure and would not affect the operation of the downstream safety-related river water supply traveling screens. Review of DAEC operating experience did not identify any previous history of aging or damage of the intake structure trash bars. Industry operating experience did identify occurrences of damage to intake structure trash bars. However, these failures occurred to intake structure trash bars exposed to a harsh sea water environment and high flow rates that are not applicable to DAEC. DAEC intake structure trash bars are exposed to non-harsh river water and experience low water velocity. The trash rake is a nonsafety-related component with a nonsafety-related function to provide for removal of trash from the inlet to the intake structure. The trash rake has not historically been needed to remove trash accumulation on the trash bars. The low river water velocity does not provide enough flow to pull debris into the intake structure trash bars and, as a result, the trash rake has not been needed or used. Therefore, the nonsafety-related intake structure trash bars or trash rake do not provide a license renewal intended function in accordance with 10 CFR 54.4(a) and are not included within the scope of license renewal.

The staff determined that the applicant had provided a discussion on the nonsafety-related functions of the intake structure trash bars and trash rake and the results of the review of plant-specific and industry-wide operating experience, which did not provide evidence of failure in mild river water and low flow operating environments similar to DAEC. The applicant had also provided an analysis which stated that if a failure did occur in the low flow environment it would not prevent the performance of the safety-related travelling screens intended function. The staff determined, based on the DAEC operating environment and the applicant's review of operating experience, that the applicant had acted appropriately in not including the nonsafety-related intake structure trash bars and trash rake within the scope of license renewal, and that the staff's concern described in RAI 2.1-2(B) 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 2.1-2, 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 consistent with the scoping criteria of 10 CFR 54.4(a)(2) and, therefore, is acceptable.

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

2.1.4.3.1 Summary of Technical Information in the Application

LRA Section 2.1.2.2.3, "Other Regulations Pursuant to 10 CFR Part 54," describes the methodology for identifying those SSCs within the scope of license renewal in accordance with the Commission's criteria for five regulated events: (1) 10 CFR 50.48, "Fire Protection," (2) 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants," (3) 10 CFR 50.61, "Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events," (4) 10 CFR 50.62, "Requirements for Reduction of Risk from Anticipated Transients Without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants," and (5) 10 CFR 50.63, "Loss of All Alternating Current Power."

<u>Fire Protection</u>. LRA Section 2.1.2.2.3, subsection 50.48 of Title 10 CFR, "Fire Protection" described scoping of systems and structures relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the fire protection criterion. LRA Section 2.1.2.2.3 states:

> The design of the Duane Arnold Fire Protection Program is based upon the defense-in-depth concept. Multiple levels of protection are provided so that should a fire occur, it will not prevent safe plant shutdown and the risk of a radioactive release to the environment will be minimized. The SSCs at Duane Arnold that support these multiple levels of protection are considered within the scope of license renewal. LRA Section 2.1.2.2.3 further states that the identification of SSCs credited with fire prevention, detection, and mitigation was accomplished via review of Duane Arnold Fire Protection Program, Fire Plan, UFSAR, and applicable licensing correspondence. These SSCs are in-scope for license renewal pursuant to criterion [of 10 CFR] 54.4(a)(3).

<u>Environmental Qualification</u>. LRA Section 2.1.2.2.3, subsection 50.49 of Title 10 CFR, "Environmental Qualification," described scoping of systems and structures relied on in safety analyses or plant evaluations to perform a function in compliance with the environmental qualification (EQ) criterion. LRA Section 2.1.2.2.3 states:

> Pursuant to [10 CFR] 50.49(b), Duane Arnold electrical equipment important to safety covered by the environmental qualification rule was identified based on the following criteria: (1) safety-related electrical equipment that is relied upon to

> remain functional during and following design basis events, (2) nonsafety electric equipment whose failure under postulated environmental conditions could prevent satisfactory accomplishment of safety functions, and (3) certain post-accident monitoring equipment.
>
> Duane Arnold established a program for qualifying the electrical equipment defined in [10 CFR] 50.49(b). For nonsafety-related electrical components whose failure under postulated environmental conditions could prevent satisfactory accomplishment of safety functions, Duane Arnold elected not to differentiate between safety-related and nonsafety-related components. If failure of an electrical component can affect safety-related functions, that electrical component is treated as if it were safety-related for environmental qualification purposes and therefore is in-scope for license renewal pursuant to criterion [in 10 CFR] 54.4(a)(3).

Pressurized Thermal Shock. LRA Section 2.1.2.2.3, subsection 50.61 of Title 10 CFR, “Pressurized Thermal Shock,” states:

> Pressurized thermal shock is not applicable to boiling water reactors. Duane Arnold is a boiling water reactor; therefore, pressurized thermal shock is not applicable to Duane Arnold.

Anticipated Transient Without Scram. LRA Section 2.1.2.2.3, subsection 50.62 of Title 10 CFR, “Anticipated Transient Without Scram,” described scoping of systems and structures relied on in safety analyses or plant evaluations to perform a function in compliance with the ATWS criterion. LRA Section 2.1.2.2.3 states:

> The systems required to meet the requirements of the anticipated transient without scram rule are the standby liquid control system and the alternate rod insertion – recirculation pump trip system. Alternate rod insertion is part of the control rod drive system. Recirculation pump trip system is part of the reactor vessel recirculation system and the 460VAC power system. Therefore, these systems are in-scope for license renewal pursuant to criterion 54.4(a)(3).

Station Blackout. LRA Section 2.1.2.2.3, subsection 50.63 of Title 10 CFR, “Station Blackout (SBO),” described scoping of systems and structures relied on in safety analyses or plant evaluations to perform a function in compliance with the SBO criterion. LRA Section 2.1.2.2.3 states:

> NUREG-1800, Revision 1, contains additional considerations related to the determination of station blackout scoping boundaries for license renewal. The NUREG addresses the determination of boundaries of the plant system portion of the offsite power system relied upon to restore offsite power for license renewal considerations. Based on a review of the Duane Arnold CLB for license renewal, and the guidance in NUREG-1800, SSCs that perform an intended function for station blackout are in-scope for license renewal pursuant to criterion [in 10 CFR] 54.4(a)(3).

2.1.4.3.2 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 pursuant to 10 CFR 54.4(a)(3) and, therefore, is acceptable.

2.1.4.4 Plant-Level Scoping of Systems and Structures

2.1.4.4.1 Summary of Technical Information in the Application

System and Structure Level Scoping. LRA Section 2.1, "Scoping and Screening Methodology," states:

> The integrated plant assessment, based on criteria in § 54.21(a), includes:
>
> - Identifying those in-scope components that are passive, long-lived, and serve an in-scope intended function.
> - Providing a description and justification for the methods used to identify SSCs that are in-scope and subject to an aging management review.
> - Providing assurance that the effects of aging are adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation.
>
> The scoping process categorizes the entire plant in terms of major systems and structures and identifies system level functions. These systems and structures are then evaluated against the scoping criteria in § 54.4(a)(1), § 54.4(a)(2), and § 54.4(a)(3). This process identifies the systems, structures, and components (SSCs) that perform or support an intended function for responding to a design basis event, are nonsafety-related and whose failure could prevent accomplishment of a safety-related function, or support a specific requirement for one of the regulated events applicable to license renewal.
>
> The screening process identifies in-scope, long-lived, passive system components and structural components that are subject to an aging management review. Commodity groups may be used to facilitate these reviews.

LRA Section 2.1.2, "Scoping Methodology," states:

> The scoping process categorizes the entire plant in terms of major systems and structures with respect to license renewal. System and structure functions are identified and evaluated against criteria provided in § 54.4(a)(1), § 54.4(a)(2), and § 54.4(a)(3) to determine whether the item should be considered within the scope of license renewal. Even if only a portion of a system or structure fulfills a scoping criterion, the system or structure is in-scope for license renewal. Eliminated are those systems and structures that do not satisfy any scoping criterion.

> The scoping methodology utilized by Duane Arnold is consistent with the guidance provided by the NRC in NUREG 1800-, by the industry in NEI 95-10. This review uses existing plant documentation, including the Duane Arnold CLB documents, controlled drawings, and the plant equipment database. Once identified as being in-scope, the systems and structures move to component and commodity group level scoping and then to the next step in the integrated plant assessment process - screening.

LRA Section 2.1.2.1, “System, Structure, and Commodity Group identification,” states:

> Systems - System identifier codes called Startup System Numbers (SUS numbers) are used to sort and track plant systems and components in the plant equipment database (EDB). This identification scheme supports plant needs with respect to maintenance work, but is not sufficient to identify license renewal system functional boundaries. For this reason, revision or the combination of some plant equipment database system identifiers was necessary for license renewal purposes.
>
> License renewal systems were defined to account for all of the plant equipment database systems that contain permanently installed equipment. Redefining system boundaries for license renewal had no impact on whether or not a system, structure, or component performs a license renewal intended function.
>
> Other information sources, such as the current licensing basis, were electronically searched using several keywords (e.g., system, new system, system modification) to ensure all plant systems were evaluated for license renewal intended functions regardless of their coverage in the plant equipment database.
>
> Structures - The plant equipment database includes buildings and structures that comprises the Duane Arnold buildings and structures. The individual buildings were input into the license renewal database as individual or grouped license renewal structures.
>
> Other information sources, such as CLB documentation, were electronically searched using several keywords (e.g., structure, new structure, building modification) to ensure all plant structures were evaluated for license renewal intended functions regardless of their coverage in the plant equipment database.
>
> Commodity Groups - Use of commodity groups occurred when component evaluations were best performed by component type, rather than by system or structure. NEI 95-10 served as guidance for commodity groupings. Components constructed from similar materials, exposed to similar environments, and which perform similar intended functions form the commodity groups. Commodity group components were not associated with a specific system or structure during the component’s evaluation, but with their assigned commodity group. Evaluation of each commodity group took place as if it were a separate, individual system. Commodity groups accounted for all electrical aging management reviews.

Consumables. LRA Section 2.1.3.3, “Component Classification (Passive, Long-Lived),” states:

> Consumables are a special class of short-lived items that can include packing, gaskets, component seals, O-rings, oil, grease, component filters, system filters, fire extinguishers, fire hoses, and air packs. Evaluation of items to determine whether or not they are consumables followed the guidance presented in Table 2.1-3 of NUREG-1800.

2.1.4.4.2 Staff Evaluation

The staff reviewed the applicant's methodology for performing the scoping of plant systems and components to ensure it was consistent with 10 CFR 54.4. The methodology used to determine the systems and components within the scope of license renewal was documented in 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 were used to determine if the system or structure performed intended functions consistent with the criteria of 10 CFR 54.4(a). The process was completed for all systems and structures to ensure that the entire plant was addressed.

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

2.1.4.5 Mechanical Component Scoping

2.1.4.5.1 Summary of Technical Information in the Application

In addition to the information previously discussed in SER Section 2.1.4.4.1, LRA Section 2.1.2.2, "Systems, Structures, Components and Commodity Group Function," states:

> Numerous sources, including Duane Arnold UFSAR, docketed correspondence with the NRC, maintenance rule documents, and design-basis documents, provided system and structure-level function information. Documentation of references used in this process was included for each system function as appropriate. The process used at DAEC identified all system-level mechanical and structure-level functions. Once system and structure-level functions were identified, and their license renewal status determined, this information was used, in combination with the plant equipment database and other information

> sources, to identify component functions and determine if these functions are in-scope for license renewal. The same scoping criteria applied at the system and structure level was applied at the component level. For the mechanical systems and the civil structures and structural components, the component intended functions were identified in LRA Table 2.1-1.

LRA Section 2.1.2.2 further states:

> In addition to the plant equipment database, the Duane Arnold P&ID's and other controlled drawings were used to identify components required to support in-scope system level and structure-level functions. These components were included in-scope for license renewal and matched information in the plant equipment database. Mechanical scoping evaluation boundaries were depicted in the license renewal drawings. The drawings consist of simplified process and instrumental drawings for mechanical systems, and a site plan drawing for major structures and buildings. The colored portions of the drawing identified the mechanical components and major structures that are subject to an aging management review. The mechanical components are colored with two different colors to distinguish between 10 CFR 54.4(a)(1), 10 CFR 54.4(a)(2) and 10 CFR 54.4(a)(3) criteria. Red indicates criteria (a)(1) or (a)(3) and green indicates criterion (a)(2).

LRA Section 2.1.1, "Plant information sources," states:

> The license renewal database used the assets of the DAEC equipment database. The component data from the plant equipment database was used to electronically populate the license renewal database. The plant equipment database does not uniquely identify all components installed in the plant. For example, the plant equipment database does not typically include items such as cables, raceways, piping, conduits, fireproofing, general construction items (e.g., nuts, bolts), or consumable materials (e.g., diesel fuel, resins, etc.). Components not uniquely identified in the plant equipment database that were in-scope for license renewal were identified as commodities or generic assets (e.g., pipe, structural steel) in their respective system or structure in the license renewal database to ensure proper coverage and evaluation.

2.1.4.5.2 Staff Evaluation

The staff evaluated LRA Section 2.1.2.2 and the guidance 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. An understanding of system operations in support of the intended functions was necessary in determining the mechanical system evaluation boundary. The staff reviewed the implementing documents and the CLB documents associated with mechanical system scoping, and finds that the guidance and CLB source information noted above were acceptable to identify mechanical components and support structures in mechanical systems that are within the scope of license renewal. The staff conducted detailed discussions with the applicant's license renewal project personnel and reviewed documentation pertinent to the scoping process. The staff assessed whether or not the applicant had appropriately applied the scoping methodology outlined in the LRA and implementing procedures and whether the scoping results were consistent with CLB requirements. The staff determined that the applicant's procedure was consistent with the description provided in the LRA Section 2.1.2.2 and the guidance contained in SRP-LR Section 2.1, and was adequately implemented.

On a sampling basis, the staff reviewed the applicant's scoping reports for the safety-related air system, residual heat removal system, and the emergency service water system, mechanical component types that met 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 mechanical component types of the safety-related air system, residual heat removal system, and emergency service water system 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 safety-related air, residual heat removal, and emergency service water 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 P&IDs to develop the license renewal boundaries in accordance with the procedural guidance. Additionally, the staff determined that the applicant had independently verified the results in accordance with the governing procedures. The staff confirmed that the applicant employed license renewal personnel knowledgeable about the system, and these personnel had performed independent reviews of the marked-up drawings to ensure accurate identification of system intended functions, and 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 the requirements of 10 CFR 54.4 and, therefore, is acceptable.

2.1.4.6 Structural Component Scoping

2.1.4.6.1 Summary of Technical Information in the Application

In addition to the information previously discussed in SER Section 2.1.4.4.1, LRA Section 2.1.2 "Scoping Methodology," and subsections state:

> System and structure functions were identified and evaluated against criteria provided in [10 CFR] 54.4(a)(1), 54.4(a)(2), and 54.4(a)(3) to determine whether the item should be considered within the scope of license renewal. The applicant identified buildings and structures using the plant equipment database, and electronically searched the CLB documentation to ensure all plant structures were evaluated for license renewal intended functions regardless of their coverage in the plant equipment database.

LRA Section 2.1.2.2, "Systems, Structures, Components and Commodity Group Function," further states:

> Numerous sources, including the Duane Arnold UFSAR, docketed correspondence with the NRC, Maintenance Rule documents, and design basis documents provided system and structure-level function information. Once

> system and structure-level functions were identified, and their license renewal status determined, this information was used in combination with the plant equipment database and other information sources to identify component functions and determine if these functions were in-scope for license renewal.

2.1.4.6.2 Staff Evaluation

The staff evaluated LRA Sections 2.1.2 and subsections, 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 described in 10 CFR 54.4(a). As part of this review, the staff discussed the methodology with the applicant, reviewed the documentation developed to support the review, and evaluated the scoping results for a sample of structures that were identified within the scope of license renewal. The staff determined that the applicant had identified and developed a list of plant structures and the structures intended functions through a review of the plant equipment database, the DAEC Structures Monitoring Program, UFSAR, DBDs, controlled drawings, maintenance 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, UFSAR, DBDs, drawings, procedures, and implementing procedures to verify the adequacy of the methodology. The staff reviewed the applicant's implementing procedures used to identify structures meeting the scoping criteria as defined by the Rule. On a sampling basis, the staff reviewed source documentation for the turbine building to verify that the application of the methodology would provide the results as documented in the turbine building scoping report and 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 was 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 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, scoping implementing procedures, and a sampling review of structural scoping results, the staff concludes that the applicant's methodology for identification of the structural SSCs within the scope of license renewal is in accordance with the requirements of 10 CFR 54.4 and, therefore, is acceptable.

2.1.4.7 Electrical Component Scoping

2.1.4.7.1 Summary of Technical Information in the Application

LRA Section 2.1.3.4, "Scoping and Screening of Electrical Equipment," states:

> Electrical component level screening was performed for "in scope" components associated with electrical and mechanical systems. Most component level screening was performed and documented in the license renewal database on a commodity basis. Components identified as being within the scope of license renewal were evaluated per NEI 95-10 Appendix B criteria to determine if the component was considered "active." Components were either screened out as

> active or were included in a commodity group. Long-lived, passive components were divided into commodity groups identified on LRA Table 2.1-2. Aging management was performed on these commodity groups. This process allowed for the quick removal of large numbers of out-of-scope and active components.

LRA Section 2.1.3.5, “Components Subject to Aging Management Review,” states:

> A component-level intended function is one that is required for the system or structure to perform its system-level intended functions.
>
> The components (or component commodity groups) that are subject to an aging management review are those in-scope components that perform a component-level intended function without moving parts or a change in configuration or properties and are not subject to replacement based on a qualified life or specified time period. Components may have more than one intended function. If a component did not have at least one component-level intended function, the component was not subject to an aging management review.
>
> Detailed scoping and screening reports have been prepared which identify all structures and components subject to an aging management review. These reports have been prepared for all systems, structures, or commodity groups (except electrical commodities) in-scope for license renewal. Electrical commodities subject to an aging management review were identified using guidance in NEI 95-10 and the EPRI 1013475, EPRI License Renewal Electrical Handbook.

2.1.4.7.2 Staff Evaluation

The staff evaluated LRA Sections 2.1.3.4 and 2.1.3.5 and subsections, 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 electrical and instrumentation and controls (I&C) SSCs relied upon to perform the functions described in 10 CFR 54.4(a). The staff reviewed portions of the documentation used by the applicant to perform the electrical scoping process including the UFSAR, plant equipment database, CLB documentation, databases and documents, procedures, drawings, specifications, and *EPRI License Renewal Electrical Handbook*. 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 electrical and instrument control (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, implementing procedures 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 electrical SSCs within the scope of license renewal is in accordance with the requirements of 10 CFR 54.4 and, therefore, is acceptable.

2.1.4.8 Conclusion for Scoping Methodology

On the basis of its review of the LRA, implementing procedures, and a sampling review of scoping results, the staff concludes that the applicant's scoping methodology was consistent with the guidance contained in the SRP-LR 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 NRC regulations for fire protection, EQ, pressurized thermal shock (PTS), ATWS, and SBO. The staff concluded that the applicant's methodology is consistent with the requirements of 10 CFR 54.4(a) and, therefore, is acceptable.

2.1.5 Screening Methodology

2.1.5.1 General Screening Methodology

2.1.5.1.1 Summary of Technical Information in the Application

LRA Section 2.1.3.2,"General Screening Methodology," and subsections, describes the screening process that identifies the structures and components within the scope of license renewal that are subject to an AMR. Section 2.1.3.2 states:

> The screening process identifies the components from the systems, structures, and commodity groups within the scope of license renewal that are subject to an aging management review. These components are those that perform or support a component-level intended function without moving parts or change in configuration or properties and that are not subject to replacement based on a qualified life or specified time period.
>
> A component-level intended function is one that supports the system-level intended function. The plant systems, structures, and commodity groups that are within the scope of license renewal and their system-level intended functions were previously identified during the scoping process.
>
> The screening process consists of the following distinctive steps:
>
> - Identification of the components that are subject to an aging management review (passive and long-lived) for each system, structure, or commodity in-scope for license renewal.
> - Identification of the component-level intended functions for all components subject to an aging management review.
> - Identification of the applicable references used to make these determinations.

2.1.5.1.2 Staff Evaluation

Pursuant to 10 CFR 54.21, each LRA must contain an IPA that identifies SCs within the scope of license renewal that are subject to an AMR. The IPA must identify components that perform an intended function without moving parts or a change in configuration or properties (passive), as well as components that are not subject to periodic replacement based on a qualified life or specified time period (long-lived). In addition, the IPA must include a description and justification of the methodology used to determine the passive and long-lived SCs, and a demonstration that the effects of aging on those SCs will be adequately managed so that the intended 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 2.1.3.2, the applicant discussed these screening activities as they related to the component types and commodity groups within the scope of license renewal.

The staff determined that the screening process evaluated the component types and commodity groups, included within the scope of license renewal, to determine which ones were long-lived and passive and, therefore, subject to an AMR. The staff reviewed LRA Section 2.3, "Scoping and Screening Results: Mechanical Systems," LRA Section 2.4, "Scoping and Screening Results: Structures and Structural Components," and LRA Section 2.5, "Scoping and Screening Results: "Electrical/Instrumentation and Controls (I&C) 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 safety-related air, residual heat removal, emergency service water, 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 which component types and commodity groups subject to an AMR is consistent with the requirements of 10 CFR 54.21 and is, therefore, acceptable.

2.1.5.2 Mechanical Component Screening

2.1.5.2.1 Summary of Technical Information in the Application

LRA Section 2.1.3.1 and subsections state:

> The screening process identifies the mechanical systems, and components within the scope of license renewal and list those mechanical components subject to an aging management review (AMR). These components are those that perform or support a component-level intended function without moving parts or change in configuration or properties and that are not subject to replacement based on a qualified life or specified time period.

A component-level intended function is one that supports the system-level intended function. The plant systems, structures, and commodity groups that are within the scope of license renewal and their system-level intended functions were previously identified during the scoping process.

As part of the screening process, components that were within the license renewal evaluation boundaries that functioned with moving parts or with a change in configuration or properties (i.e., active components) were identified. An AMR was not required for these components. Appendix B to NEI 95-10 Revision 6, provides guidance regarding component types generally classified as passive or active.

The screening process also identified those components classified as short-lived. If a work control document was found to provide for the periodic replacement of the component, or the component was found to have an established qualified life, the component has been identified as short-lived and an AMR was not required for that component. A component that was determined to be active or short-lived is not subject to an AMR, and is screened out by the process.

2.1.5.2.2 Staff Evaluation

The staff reviewed the mechanical screening methodology discussed and documented in LRA Section 2.1.3.1, the implementing documents, 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 depicted on the P&IDs to identify passive and long-lived components.

Additional, the staff determined that the applicant had identified all passive and long-lived components that perform or support an intended function within the system evaluation boundaries and determined those components to be subject to an AMR. The results of the review were documented in the scoping and screening reports, which contain information such as the information sources reviewed and the component intended functions.

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

The staff reviewed selected portions of the UFSAR, plant equipment database, CLB documentation DAEC databases and documents, procedures, drawings, specifications, and selected scoping and screening reports. The staff conducted detailed discussions with the applicant’s license renewal team and reviewed documentation pertinent to the screening process. The staff also included an extensive walkdown of the plant with plant engineers to verify selected documentation. The staff assessed whether or not the mechanical screening methodology outlined in the LRA and procedures was appropriately implemented and if the scoping results were consistent with CLB requirements. During the scoping and screening methodology audit, the staff discussed the screening methodology with the applicant and on a sampling basis, reviewed the applicant’s screening reports for the safety-related air system, residual heat removal, and emergency service water systems to verify proper implementation of the screening process. Based on these audit activities, the staff did not identify any discrepancies between the methodology documented and the implementation results.

2.1.5.2.3 Conclusion

On the basis of its review of the LRA, the screening implementation procedures, selected portions of the UFSAR, plant equipment database, CLB documentation, procedures, drawings, specifications and selected scoping and screening reports, and a sample of the safety-related air system, the residual heat removal system, and the emergency service water system, 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 the requirements of 10 CFR 54.21(a)(1) and, therefore, is acceptable.

2.1.5.3 Structural Component Screening

2.1.5.3.1 Summary of Technical Information in the Application

LRA Section 2.1.3.2, "General Screening Methodology," states:

> The screening process identifies structural components within the scope of license renewal that are subject to an aging management review. These components are those that perform or support a component-level intended function without moving parts or change in configuration or properties and that are not subject to replacement based on a qualified life or specified time period. The LRA further states that a component-level intended function is one that supports the system-level intended function. The steps taken for the screening process include the (1) identification of the components that are subject to an aging management review (passive and long-lived) for each system, structure, or commodity in-scope for license renewal, (2) identification of the component-level intended functions for all components subject to an aging management review, and (3) identification of the applicable references used to make these determinations.

2.1.5.3.2 Staff Evaluation

The staff reviewed the structural screening methodology discussed and documented in LRA Section 2.1.3.2, the implementing procedures, the scoping reports, and the license renewal drawings. The staff reviewed the applicant's methodology for identifying structural components that are subject to an AMR as required in 10 CFR 54.21(a)(1). The staff confirmed that the applicant 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 UFSAR, DAEC structures monitoring program, DBDs, 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 structural drawing to document the structures and components within the scope of license renewal. Using the turbine building as an example, the staff conducted 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 screening results were consistent with the CLB requirements. 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 UFSAR, the Structures Monitoring Program documentation, DBDs, scoping and screening reports, and a sampling review of the turbine building results, the staff concludes that the methodology for identification of structural components within the scope of license renewal and subject to an AMR is in accordance with the requirements of the 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 2.1.3.4, "Scoping and Screening of Electrical Equipment," states:

> Component level screening was performed for "in-scope" components associated with electrical and mechanical systems. Most component level screening was performed and documented in the license renewal database on a commodity basis. Components identified as being within the scope of license renewal were evaluated per NEI 95-10 Appendix B criteria to determine if the component was considered "active." Components were either screened out as active or were included in a commodity group. Long-lived, passive components were divided into commodity groups identified on LRA Table 2.1-2. Aging management was performed on these commodity groups. This process allowed for the quick removal of large numbers of out-of-scope and active components. Mechanical systems contain some electrical only components (relays, power supplies, motors, etc.). Because electrical components are evaluated on a commodity basis or screen out due to active functions, it was not necessary to track each individual component (either in a mechanical document or in an electrical document). Existing electrical components in the equipment database were transferred to the license renewal database, but not evaluated on an individual basis.

2.1.5.4.2 Staff Evaluation

The staff reviewed the applicant's methodology used for electrical screening in LRA Section 2.1.3.4 and subsections, implementing procedures, bases documents, and reports. The staff confirmed that the applicant used the screening process described in these documents along with the information contained in NEI 95-10 Appendix B and the SRP-LR, to identify the electrical and I&C components subject to an AMR.

The staff determined that the applicant 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 indicate whether or not they were subject to replacement based on a qualified life or specified time period (short-lived), or not subject to replacement based on a qualified life or specified time period (long-lived) and that the remaining passive, long-lived components were determined to be subject to an AMR.

The staff reviewed selected portions of the UFSAR, plant equipment database, CLB documentation, DAEC databases and documents, procedures, drawings, specifications, and selected scoping and screening reports. The staff conducted detailed discussions with the applicant's license renewal team and reviewed documentation pertinent to the screening process. The staff assessed whether or not the electrical screening methodology outlined in the LRA and procedures was appropriately implemented and if the scoping results were consistent with CLB requirements. During the scoping and screening methodology audit, the staff discussed the screening methodology with the applicant and on a sampling basis, reviewed the applicant's screening reports for the safety-related air, residual heat removal, and emergency service water systems to verify proper implementation of the screening process. Based on these audit activities, the staff did not identify any discrepancies between the methodology documented and the implementation results.

2.1.5.4.3 Conclusion

On the basis of its review of the LRA, the screening implementation procedures, selected portions of the UFSAR, plant equipment database, CLB documentation, procedures, drawings, specifications and selected scoping and screening reports, 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 the requirements of 10 CFR 54.21(a)(1) and, therefore, is acceptable.

2.1.5.5 Conclusion for Screening Methodology

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

2.1.6 Summary of Evaluation Findings

On the basis of its review of the information presented in LRA Section 2.1, the supporting information in the 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 dated December 2, 2009, to the staff's RAIs, the staff confirms that the applicant's scoping and screening methodology is in accordance with the requirements of 10 CFR 54.4 and 10 CFR 54.21(a)(1). The staff also concludes that the applicant's description and justification of its scoping and screening methodology are adequate to meet the requirements of 10 CFR 54.21(a)(1). From this review, the staff concludes that the applicant's methodology for identifying systems and structures within the scope of license renewal and SCs requiring an AMR is acceptable.

2.2 <u>Plant-Level Scoping Results</u>

2.2.1 Introduction

LRA Section 2.1 describes the methodology for identifying SSCs within the scope of license renewal. In LRA Section 2.2, the applicant used the scoping methodology to determine which SSCs must be included within the scope of license renewal. The staff reviewed the plant-level scoping results to determine whether or not the applicant has properly identified all systems and structures relied upon to mitigate DBEs, as required by 10 CFR 54.4(a)(1), systems and structures the failure of which could prevent satisfactory accomplishment of any safety-related functions, as required by 10 CFR 54.4(a)(2), and systems and structures relied on in safety analyses or plant evaluations to perform functions required by regulations referenced in 10 CFR 54.4(a)(3).

2.2.2 Summary of Technical Information in the Application

LRA Tables 2.2.1, 2.2.2, and 2.2.3 list plant mechanical systems, electrical and instrumentation and controls systems, and structures within the scope of license renewal. Based on the DBEs considered in the plant's CLB, other CLB information relating to nonsafety-related systems and structures, and certain regulated events, the applicant identified plant-level systems and structures within the scope of license renewal as defined by 10 CFR 54.4.

2.2.3 Staff Evaluation

LRA Section 2.1 describes its methodology for identifying systems and structures within the scope of license renewal and subject to an AMR. The staff reviewed the scoping and screening methodology and provides its evaluation in SER Section 2.1. To verify that the applicant properly implemented its methodology, the staff's review focused on the implementation results shown in LRA Table 2.2-1, Table 2.2-2, Table 2.2-3, Table 2.2-4, Table 2.2-5, and Table 2.2-6 to confirm that there were no omissions of plant-level systems and structures within the scope of license renewal.

The staff determined whether or not the applicant properly identified the systems and structures within the scope of license renewal, in accordance with 10 CFR 54.4. The staff reviewed selected systems and structures that the applicant did not identify as within the scope of license renewal to verify if 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 LRA Section 2.2, the staff identified an area in which additional information was necessary to complete the review of the applicant's plant-level scoping results. The applicant responded to the staff's RAI as discussed below.

In RAI 2.2-01, dated August 7, 2009, the staff noted the following UFSAR systems could not be located in Table 2.2-1 or Table 2.2-2.

UFSAR Section	System
1.3.2.1 1.2 General Service Water System	Turbine Building Cooling Water System
12.3.3.3.3 Technical Support Center Radiation Monitoring System	Technical Support Center Radiation Monitoring System
9.5.8 Diesel-Generator Combustion Air Intake	Diesel-Generator Combustion Air Intake

and Exhaust System	and Exhaust System

The applicant was requested to provide the reasoning for not including the above systems in Table 2.2-1 or Table 2.2-2.

In its response, by letter dated September 3, 2009, the applicant stated the turbine building cooling water system is the portion of the general service water system that is in the turbine building. The general service water system is listed in Table 2.2-1. The technical support center radiation monitoring system is part of the technical support center heating, ventilation and air conditioning system listed in Table 2.2-2. The diesel-generator combustion air intake and exhaust system is in-scope but under two systems, plant ventilation and the standby diesel generator system both of which are listed in Table 2.2-1.

Based on its review, the staff finds the applicant's response to RAI 2.2-01 acceptable because the applicant clarified that the systems in question are subsystems of systems listed in Tables 2.2-1 and 2.2-2. Therefore, the staff's concern described in RAI 2.2-01 is resolved.

2.2.4 Conclusion

The staff reviewed LRA Section 2.2, the RAI response, and the UFSAR supporting information to determine whether or not the applicant failed to identify any systems and structures within the scope of license renewal. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant has adequately identified the systems and structures within the scope of license renewal, in accordance with 10 CFR 54.4.

2.3 Scoping and Screening Results: Mechanical Systems

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

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

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

In accordance with the requirements of 10 CFR 54.21(a)(1), the applicant must list passive, long-lived SCs within the scope of license renewal and subject to an AMR. To verify that the applicant properly implemented its methodology, the staff's review focused on the implementation results. This focus allowed the staff to confirm that there were no omissions of mechanical 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 mechanical systems. The objective was to determine whether or not the applicant has identified, in accordance with 10 CFR 54.4, components and supporting structures for mechanical systems that appear to meet the license renewal scoping criteria. Similarly, the staff evaluated the applicant's screening results to verify that all passive, long-lived components were subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

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

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

2.3.1 Reactor Coolant System

LRA Section 2.3.1 identifies the nuclear bolier and reactor vessel recirculation system SCs subject to an AMR for license renewal.

The applicant described the supporting SCs of the nuclear boiler and reactor vessel recirculation system in the following LRA sections:

- 2.3.1.1 nuclear boiler
- 2.3.1.2 reactor vessel recirculation system

The staff's findings on review of LRA Sections 2.3.1.1–2.3.1.2 are in SER Sections 2.3.1.1–2.3.1.2, respectively.

2.3.1.1 Nuclear Boiler

2.3.1.1.1 Summary of Technical Information in the Application

LRA Section 2.3.1.1 describes the reactor pressure vessel and reactor pressure vessel internals which contain the core (including the fuel, channels, control blades, incore flux monitor guide tubes, control rod guide tubes, and core instrumentation), core support structures, control rods, and other parts of the core. The reactor pressure vessel is a vertical, cylindrical pressure vessel with hemispherical heads of welded construction. The cylindrical shell and bottom hemispherical head of the reactor pressure vessel are fabricated of low-alloy steel plate that is clad on the interior with stainless steel overlay.

The reactor pressure vessel top head is secured to the reactor pressure vessel by studs, nuts, and bushings. The reactor pressure vessel flanges are sealed by two concentric rings designed for no leakage through the inner or outer seal at any operating condition.

The reactor vessel internal components include the core (including the fuel, channels, control blades, incore flux monitor guide tubes, control rod guide tubes, and core instrumentation), core support structure (including the core shroud, top guide, fuel support pieces, and core plate), shroud head and steam separator assembly, steam dryer assembly, feedwater spargers, core spray spargers, differential pressure and liquid control line, surveillance sample holders, and jet pump assemblies.

The intended functions of the nuclear boiler within the scope of license renewal include the following:

- maintain reactor coolant pressure boundary
- maintain reactor core geometry to provide a floodable volume in which the core can be adequately cooled in the event of a breach in the reactor coolant pressure boundary external to the reactor vessel
- maintain reactor core geometry to ensure that the control rods and emergency core cooling systems (ECCS) can perform their safety functions
- the RPV contains and supports the reactor core, the reactor internals, jet pumps, and the reactor core coolant moderator, and maintains proper alignment of the reactor core, control rods, and control rod drives
- the fuel cladding provides fission product retention capability
- the reactor pressure vessel contains and provides steam for direct use by the ECCS turbine driven pumps
- provide isolation for selected primary system boundary lines

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 Conclusion

The staff reviewed the LRA and UFSAR and drawings 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 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 adequately identified the reactor pressure vessel components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.1.2 Reactor Vessel Recirculation System

2.3.1.2.1 Summary of Technical Information in the Application

LRA Section 2.3.1.2 describes the reactor vessel recirculation system. The system provides a variable rate of reactor coolant flow to the reactor core so that proper thermal margin is maintained during normal reactor operation. The reactor vessel recirculation system consists of two recirculation loops external to the reactor vessel which provide the driving flow of water to sixteen reactor vessel jet pumps. The recirculation loops are part of the reactor coolant pressure boundary and are located inside the drywell.

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

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

- maintain reactor coolant pressure boundary
- support primary containment isolation
- act as a pressure-retaining boundary for sufficient flow delivery at adequate pressure or fission product barrier for containment isolation and fission product retention

2.3.1.2.2 Conclusion

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

2.3.2 Engineered Safety Features

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

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

- 2.3.2.1 core spray system
- 2.3.2.2 high-pressure coolant injection (HPCI) system
- 2.3.2.3 primary containment
- 2.3.2.4 reactor core isolation cooling (RCIC) system
- 2.3.2.5 residual heat removal (RHR) system
- 2.3.2.6 standby gas treatment system (SGTS)

The staff's findings on review of LRA Sections 2.3.2.1–2.3.2.6 are in SER Sections 2.3.2.1–2.3.2.6, respectively.

2.3.2.1 Core Spray System

2.3.2.1.1 Summary of Technical Information in the Application

LRA Section 2.3.2.1 describes the core spray system, which maintains core coolant inventory to prevent fuel damage, which limits, in conjunction with the primary and secondary containments, the release of radioactive materials to the environs following a design-basis accident. The core spray system consists of two independent loops. Each loop includes one 100 percent capacity centrifugal pump driven by an electric motor, a spray sparger in the reactor vessel above the core, piping and valves that convey water from the suppression pool to the sparger, and associated controls and instrumentation.

The two core spray system loops pump water into peripheral ring spray spargers mounted above the reactor core. The core spray system provides inventory makeup and spray cooling during a large break LOCA in which the core is uncovered.

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

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

- core cooling
- maintain integrity of reactor coolant pressure boundary
- support primary containment isolation

2.3.2.1.2 Conclusion

The staff reviewed the LRA and UFSAR 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 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 adequately identified the core spray system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.2.2 High Pressure Coolant Injection System

2.3.2.2.1 Summary of Technical Information in the Application

LRA Section 2.3.2.2 describes the HPCI system, which is provided to maintain reactor vessel water inventory after small breaks that do not depressurize the reactor vessel. The purpose of high pressure coolant injection is to limit, in conjunction with the primary and secondary containments, the release of radioactive materials to the environs following a LOCA. The HPCI system consists of a steam-driven turbine that drives constant flow pumps, and associated system piping, valves, controls, and instrumentation. Steam is supplied to the turbine from a tap on the "B" main steam line. Steam from the turbine is exhausted to the suppression pool. The pump is designed to pump water at high pressure from the suppression pool or condensate storage tank to the reactor through a connection on the feedwater supply pipe.

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

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

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

- provide core cooling following postulated design basis events
- maintain reactor coolant pressure-boundary
- provide primary containment isolation

2.3.2.2.2 Conclusion

The staff reviewed the LRA and UFSAR, and drawings 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 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 adequately identified the HPCI system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.2.3 Primary Containment

2.3.2.3.1 Summary of Technical Information in the Application

LRA Section 2.3.2.3 describes the primary containment system which contains primary containment, traversing incore probe system, and drywell access control. The primary containment is a Mark I containment system employing a drywell and a separate pressure suppression chamber. The drywell houses the reactor vessel, the reactor recirculation loops, and branch connections of the reactor coolant system that have isolation valves at the primary containment boundary. The pressure suppression chamber (torus) consists of an air volume and a suppression water volume. The drywell and torus are connected through a vent system which directs flow from the drywell into the suppression water of the torus through submerged downcomers.

The traversing incore probe system is a subsystem of the nuclear monitoring system. This system allows the calibration of the local power range monitors by correlating traversing incore probe signals to local power range monitor signals.

The drywell access control is one double-door airlock that provides access to the drywell and provides containment isolation during the process of personnel entering and exiting the drywell. The airlock limits the release of radioactive material to the environment during normal operation, transients, and design basis accidents

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

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

- provide containment pressure boundary
- provide primary containment isolation
- monitor suppression pool and containment water level

2.3.2.3.2 Conclusion

The staff reviewed the LRA and UFSAR 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 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 adequately identified the primary containment components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.2.4 Reactor Core Isolation Cooling System

2.3.2.4.1 Summary of Technical Information in the Application

LRA Section 2.3.2.4 describes the RCIC system. This system provides core cooling during reactor isolation by pumping makeup water into the reactor vessel to prevent low water level. The RCIC consists of a steam turbine-driven pump unit and associated valves and piping capable of delivering makeup water to the reactor vessel. RCIC turbine-driven pump assembly is powered by steam from the main steam header.

The RCIC pump suction is normally aligned to the condensate storage tank, with a backup supply available from the suppression pool. The pump discharges to either the feedwater line for injection into the reactor vessel or a full-flow test line. The RCIC pump discharge also provides cooling water for the barometric condenser and to the RCIC turbine lube oil cooler.

The RCIC system is assumed to supply water to the reactor pressure vessel in SBO analyses since it does not require AC power.

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

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

- provide core cooling following postulated design basis events
- maintain reactor coolant pressure-boundary
- provide primary containment isolation

2.3.2.4.2 Conclusion

The staff reviewed the LRA, UFSAR, and drawings 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 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 adequately identified the RCIC system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.2.5 Residual Heat Removal System

2.3.2.5.1 Summary of Technical Information in the Application

LRA Section 2.3.2.5 describes the RHR system. The purpose of the RHR system is to restore and maintain the coolant inventory in the reactor vessel so that the core is adequately cooled after a LOCA and to provide core cooling during a normal shutdown. The RHR system provides spray cooling for the primary containment in the event of a LOCA to limit containment temperature and pressure by condensing steam released in the containment.

The RHR is a two-loop system containing two heat exchangers and four residual heat removal pumps. The loops are physically separated from each other and a single header cross connects the two loops, making it possible to supply either loop from the pumps in the other loop. A spool piece is permanently installed on the shutdown cooling piping for making connection to the fuel pool system so that the RHR system can provide assistance to cooling the fuel pool. The RHR system is normally lined up for automatic actuation in the low pressure coolant injection mode.

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

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

- provide core cooling following postulated design basis events
- maintain reactor coolant pressure-boundary
- provide primary containment isolation

2.3.2.5.2 Conclusion

The staff reviewed the LRA, UFSAR, and drawings 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 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 adequately identified the residual heat removal system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.2.6 Standby Gas Treatment System

2.3.2.6.1 Summary of Technical Information in the Application

LRA Section 2.3.2.6 describes the SGTS. The system is a subsystem of the secondary containment and consists of two identical parallel air filtration assemblies. With the reactor building isolated, each train can hold the building at a sub-atmospheric pressure of 0.25 inches of water.

The SGTS system limits the release of airborne radioactivity to the environment so that offsite doses from a postulated design-basis accident will be below the guideline values of 10 CFR 50.67 and RG 1.183. The standby gas treatment system is comprised of redundant filter trains, with common suction ductwork and a common discharge pipe to the off-gas vent stack. The systems also includes components to deluge the carbon beds in the event of a fire.

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

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

- limit the release of airborne radioactivity to the environment so that offsite doses from a postulated design-basis accident will be below regulatory limits
- systems contains components credited in CLB for EQ and fire protection

2.3.2.6.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.6 and UFSAR Section 6.5.3 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions 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 the requirements of 10 CFR 54.21(a)(1).

During its review of LRA Section 2.3.2.6, the staff identified area(s) 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 2.3.2.6-1, dated August 7, 2009, the staff requested that applicant provide clarification for not listing component types for bolting, washers, and nuts, screens and strainer, damper, damper housing, fire damper housing, valve, and exhaust fan housing in LRA Table 2.3.2-6; valve body, damper housing, fire damper housing, and exhaust fan housing in LRA Table 3.2.2-6; and other component types for wall sealants in above identified LRA tables.

By letter dated September 3, 2009, the applicant provided an enclosure showing a correlation for component types listed in the tables of LRA Section 2.3. The component types listed in the tables of LRA Section 2.3 were the common component categories that were used in the license renewal database to group the components that are in-scope for license renewal.

Based on the correlation guidelines of the enclosure, the applicant clarified component types as follows:

- Table 2.3.2-6 component type "fastener" is equivalent to the Table 3.2.2-6 component type "fasteners, bolting, washers, nuts."

- Table 2.3.2-6 component type “filters” is equivalent to component type “filter, screens” in Table 3.2.2-6.
- Damper housing, fan housing, and exhaust fan housing are not shown as separate line items in Table 2.3.2-6 since they are included in the component type “piping” in Table 2.3.2-6 and the equivalent component type “pipe, pipe fittings, hoses, tubes, rupture disks” in Table 3.2.2-6.
- The component types “valve body” in Table 2.3.2-6 and “valve, damper” in Table 3.2.2-6 include valves, dampers, and valve bodies.
- Fire damper housings are included in the component type “valve body” in Table 2.3.3-11 and in the line item “valve, damper” in Table 3.3.2-11.
- Wall sealants are evaluated in the civil/structural area as elastomers in LRA Sections 2.4 and 3.5.

Based on the above, the applicant concluded that a revision is not necessary for LRA Tables 2.3.2-6 and 3.2.2-6.

Based on its review, the staff finds the applicant’s response to RAI 2.3.2.6-1 acceptable because the applicant provided an acceptable correlation such that the component types are properly identified as within the scope of license renewal, and 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). Therefore, the staff’s concern described in RAI 2.3.2.6-1 is resolved.

2.3.2.6.3 Conclusion

The staff reviewed the LRA, UFSAR, 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 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 adequately identified the standby gas treatment system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3 Auxiliary Systems

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

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

- 2.3.3.1 auxiliary heating boiler
- 2.3.3.2 building sumps
- 2.3.3.3 chlorination and acid feed system
- 2.3.3.4 circulating water system

- 2.3.3.5 containment atmosphere control system
- 2.3.3.6 control building heating, ventilation, and air conditioning
- 2.3.3.7 control rod drive system
- 2.3.3.8 drywell sumps
- 2.3.3.9 electrical manhole sump pump
- 2.3.3.10 emergency service water system
- 2.3.3.11 fire protection system
- 2.3.3.12 fuel pool cooling and cleanup system and fuel pools and auxiliaries
- 2.3.3.13 general service water system
- 2.3.3.14 hydrogen water chemistry system
- 2.3.3.15 instrument air system
- 2.3.3.16 intake and traveling screens
- 2.3.3.17 off-gas exhaust system
- 2.3.3.19 post-accident sampling system
- 2.3.3.20 primary containment heating, ventilation, and air conditioning
- 2.3.3.21 reactor building and radwaste building sampling system
- 2.3.3.22 reactor building closed cooling water system
- 2.3.3.23 reactor building heating, ventilation, and air conditioning
- 2.3.3.24 reactor water cleanup system
- 2.3.3.25 RHR service water system
- 2.3.3.26 river water supply system
- 2.3.3.27 safety-related air system
- 2.3.3.28 solid radwaste
- 2.3.3.29 standby diesel generator
- 2.3.3.30 standby liquid control system
- 2.3.3.31 turbine building sampling system

- 2.3.3.32 well water system
- 2.3.3.33 zinc injection system

Auxiliary Systems Generic Requests for Additional Information. As part of the staff's review, the following RAI identified instances of license renewal drawing errors where the continuation notation for piping from one license renewal drawing to another license renewal drawing could not be identified or was incorrect.

In RAI 2.3-01, dated August 7, 2009, the staff noted drawings where the staff was unable to identify the license renewal boundary because: (1) continuations were not provided or were incorrect, or (2) the continuation drawing was not provided. The applicant was requested to provide additional information to locate the continuations described below.

LRA Section/Drawing	Issue
Section 2.3.3.13	
BECH-M146-LR	Location B-4 shows a 4"-JBD-1 line as in-scope for license renewal for 10 CFR 54.4(a)(2). The line is continued to BECHC140 but the continuation location and drawing are not provided.
Section 2.3.3.15	
BECH-M173-LR	Locations C-5 and E-5 show continuations of 10 CFR 54.4(a)(1) 2"-KBF-1 piping sections from drawing M133 (E-6). Review of drawings BECH-M133<1, 2, 3, 4, 5>-LR could not locate the continuations to drawing BECH-M173-LR. Location A-5 shows a continuation of a 10 CFR 54.4(a)(1) pipe section (pneumatic signal) to drawing BECH-M158-LR (C-2) (to CV5837B). Review of drawing BECH-M158-LR could not locate the continuation at C-2 but a possible, continuation was found at location A-5.
Section 2.3.3.22	
BECH-M116-LR	Location (A-5) shows a continuation of 10 CFR 54.4(a)(2) pipe section (2"-HCC-133) to drawing BECH-M137-LR (C-7). Review of drawings BECH-M137<1>-LR and BECH M137<2>-LR could not locate the continuation from BECHM116-LR.
Section 2.3.3.27	
BECH-M158-LR	Location A-6 shows a continuation of a 10 CFR 54.4(a)(3) pipe section (3"-KBF-1 from Fire Protection System) from drawing BECH-M133<1>-LR (D-5). Review of drawing BECH-M133<1>-LR could not locate the continuation to BECH-M158-LR.
BECH-M161-LR	Location D-5 shows a continuation a pipe section (before valve V61-0116) from the same drawing, however, review of drawing BECH-M161-LR could not locate the continuation. Location E-7 shows a continuation of a pipe section (1 ½"-HBD-163) from drawing BECH-M160<2>-LR. Drawing BECH-M160<2>-LR was not provided with the LRA.
Section 2.3.3.31	
BECH-M106-LR	Location B-5 shows continuation of the line downstream

LRA Section/Drawing	Issue
	of valve V06-0194 to drawing BECH-M147 (H-6). Location H-6 does not exist on drawing BECH-M147-LR.
BECH-M147-LR	Location E-1 shows continuation of the line downstream of valve V47-0117; however, no continuation location is provided.
Section 2.3.3.32	
BECH-M161-LR	Location B-6 shows a continuation with a notation to see note 9. Note 9 refers to M527 which was not provided with the LRA.
Section 2.3.4.1	
BECH-M136-LR	Location D-4 shows line ½”-HCD-40 downstream of valve V36-0078 with a system boundary interface for systems 37.00 and 68.00. However, the location of the license renewal boundary cannot be determined.
Section 2.3.4.2	
BECH-M 1 03<3>-LR	Location B-6 downstream of valve Location B-6 downstream of valve V03-0158 Location B-6 downstream of valve V03-0151 Location B-6 downstream of valve V03-0153 Location B-6 downstream of valve V03-0155 Location A-6 downstream of valve V03-0150 Location B-5 downstream of valve V03-0157 Location B-5 downstream of valve V03-0161 Location A-5 downstream of valve V03-0162 Location B-2 downstream of valve V03-0138
BECH-M104<2>-LR	Location D-6 downstream of HP Heater 1 E006A (to CV1158A)
BECH-M104<3>-LR	Location D-6 downstream of valve V04-0050
BECH-M107-LR	Location D-2 downstream of valve V07-0314 Location E-8 downstream of valve V07-0318
Section 2.3.4.4	
BECH-M114-LR	Location B-2 shows an in-scope line continuation to MSIV drawing M184 (H-2). However, this continuation cannot be found on BECH-M184-LR.

In its response dated September 3, 2009, the applicant provided sufficient information to locate the license renewal boundaries.

Based on its review, the staff finds the applicant’s response to RAI 2.3-01 acceptable because the applicant provided the continuation locations. Therefore, the staff’s concern described in RAI 2.3-01 is resolved.

2.3.3.1 Auxiliary Heating Boiler

2.3.3.1.1 Summary of Technical Information in the Application

LRA Section 2.3.3.1 describes the auxiliary heating boiler system. This system operates as a standby for the plant heating system when the plant is operating and the feedwater heater drains are used as the primary heat source. The system is used to provide heat whenever the plant is shut down during cold weather. Removable spool pieces are provided for temporary connection of the plant heating steam to the HPCI and RCIC systems. Blind flanges are provided to isolate the systems when the spool pieces are not in use. There is no permanent connection from the plant heating boiler system to any safety-related equipment.

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

The intended function of the auxiliary heating boiler system component type within the scope of license renewal is maintenance of nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of a safety-related function due to spatial proximity.

2.3.3.1.2 Conclusion

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

2.3.3.2 Building Sumps

2.3.3.2.1 Summary of Technical Information in the Application

LRA Section 2.3.3.2 describes the building sump system, which provides a means to collect drainage from the associated buildings and direct it for proper handling. Where automatic fire water suppression systems are located in the building, the building sump system ensures excessive water accumulation is avoided.

The failure of nonsafety-related SSCs in the building sump system potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the building sump system performs functions that support fire protection.

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

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

- components credited in the CLB for fire protection
- maintenance of nonsafety-related SSCs directly connected to safety-related SSCs up to, and including, the first equivalent anchor beyond the safety/nonsafety-related interface that provides support to safety-related SSCs

2.3.3.2.2 Conclusion

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

2.3.3.3 Chlorination and Acid Feed System

2.3.3.3.1 Summary of Technical Information in the Application

LRA Section 2.3.3.3 describes the chlorination and acid feed system, which provides the means to add chemicals to circulating water. Sulfuric acid, corrosion inhibitor, surfactant, and silt dispersant are added to the circulating water pit. Sodium hypochlorite is added to the discharge of the circulating water and general service water pumps. The chlorination system is also used to treat the RHR service water and emergency service water systems to prevent biological growth, corrosion, and fouling. The copper ion injection system is included in the chlorination and acid feed system. The copper ion injection system is installed at the intake structure and prevents growth of Bryozoa in underground piping and downstream components. The copper is toxic to Bryozoa and other marine organisms, such as algae and mussels.

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

The intended function of the chlorination and acid feed system component types within the scope of license renewal is maintenance of nonsafety-related SSCs whose failure could prevent against adverse physical interaction that could cause safety-related SSC failure.

2.3.3.3.2 Conclusion

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

2.3.3.4 Circulating Water System

2.3.3.4.1 Summary of Technical Information in the Application

LRA Section 2.3.3.4 describes the circulating water system, which provides water from the circulating water pump pit to the main condenser to absorb heat from the main turbine exhaust. The circulating water system is a closed loop system with two motor-driven pumps circulating water through the main condenser and two induced-draft cooling towers. The pumps take suction from a sump which is gravity-fed from the cooling tower basins. The fire protection system also draws water from this source. The flowpaths through the low pressure and high pressure condensers are designated the inner loop and the outer loop. The heated water leaves the condenser and moves to the cooling towers to transfer heat to the environment. The tower-cooled water is gravity fed to the circulating water pump pit. During normal operation, both circulating water pumps and both cooling towers are in service.

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

The intended function of the circulating water system component types within the scope of license renewal is maintenance of nonsafety-related SSCs whose failure could prevent against adverse physical interaction that could cause safety-related SSC failure.

2.3.3.4.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.4 and UFSAR Section 10.4.5 and the license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant 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 the requirements of 10 CFR 54.21(a)(1).

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 2.3.3.4-01, dated August 7, 2009, the staff noted license renewal drawing BECH-M142-LR (E-8) upstream of vent V42-0020, shows a "bellow" shaped component as in-scope for license renewal for 10 CFR 54.4(a)(2) whereas a similar component at location E-7 upstream of vent V42-0019 is shown as not within scope for license renewal. The applicant was requested to provide additional information explaining why the component is not within the scope of license renewal and subject to an AMR.

In its response dated September 3, 2009, the applicant stated the component upstream of vent V42-0019 is a representation of a pipe fitting and is within the scope of license renewal for 10 CFR 54.4(a)(2).

Based on its review, the staff finds the applicant's response to RAI 2.3.3.4-01 acceptable because the applicant clarified and corrected the scoping classification of the pipe fitting in question. Therefore, the staff's concern described in RAI 2.3.3.4-01 is resolved.

In RAI 2.3.3.4-02, dated August 7, 2009, the staff noted license renewal drawing BECH-M142-LR (C-8) at component AT4254, shows flexible connections as in-scope for license renewal for 10 CFR 54.4(a)(2). LRA Table 2.3.3-4 which lists components that require AMR does not include these flexible connections. The applicant was requested to provide additional information explaining why flexible connectors are not included in LRA Table 2.3.3-4.

In its response dated September 3, 2009, the applicant stated that the flexible connections are incorrectly shown as within scope for license renewal and subject to an AMR. The applicant has placed these flexible connections on a preventive maintenance schedule for periodic replacement and they are now not subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.4-02 acceptable because the applicant placed these flexible connections on a preventive maintenance schedule for periodic replacement. Therefore, the staff's concern described in RAI 2.3.3.4-02 is resolved.

2.3.3.4.3 Conclusion

The staff reviewed the LRA, UFSAR, RAI responses, and applicable license renewal drawings 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 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 adequately identified the circulating water system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.5 Containment Atmosphere Control System

2.3.3.5.1 Summary of Technical Information in the Application

LRA Section 2.3.3.5 describes the containment atmosphere control system comprised of the following subsystems: containment atmosphere monitoring and containment vacuum breakers. The containment atmosphere monitoring consists of two separate redundant systems or loops which each contain a hydrogen-oxygen analyzer, a radioactivity monitor, and associated valves and piping. Each loop is capable of sampling from one of three locations, two drywell points and one torus point. During normal operation, both hydrogen and oxygen monitor loops are in standby subject to monthly testing. A separate oxygen monitor provides continuous monitoring of containment oxygen concentrations. Hydrogen and oxygen concentrations are recorded and displayed on dual scale meters.

The primary containment is designed for an internal/external differential pressure not to exceed two pounds per square inch differential (psid.) To ensure that this pressure is not exceeded, there are two groups of vacuum breakers. The torus to drywell group prevents drywell pressure from being significantly less than torus pressure and the reactor building to torus group prevents the torus from being significantly lower than reactor building pressure.

The torus to drywell group consists of seven check valves which are located on the vent header in the suppression chamber air space. These valves are equipped with pneumatic operators to allow for remote testing, and have a counter balance and magnet to assure closure after operation. The reactor building to torus group consists of two vacuum breaker check valves and two air-operated butterfly valves in series with the check valves. The air-operated valves each have their own accumulator and open on a differential pressure signal. Each vacuum breaker is of adequate size to prevent the containment from exceeding its negative design pressure.

The containment atmosphere control system contains nonsafety-related SSCs that potentially could prevent the satisfactory accomplishment of safety-related SSCs. In addition, the containment atmosphere control system performs functions that support fire protection, EQ and SBO.

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

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

- prevent the containment design external-internal pressure differential from being exceeded

- maintain pressure boundary
- maintain primary containment isolation
- maintenance of nonsafety-related component structural and pressure boundary integrity against adverse physical interaction that could cause safety-related SSC failure

2.3.3.5.2 Conclusion

The staff reviewed the LRA and UFSAR 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 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 adequately identified the containment atmosphere control system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.6 Control Building Heating, Ventilation, and Air Conditioning

2.3.3.6.1 Summary of Technical Information in the Application

LRA Section 2.3.3.6 describes the control building heating, ventilation, and air conditioning, which services the control room, heating, ventilation, and air conditioning equipment room, computer room, cable spreading room, battery room, and the switchgear rooms.

The control room is served by an air conditioning system that also serves the cable spreading room, battery rooms, and essential switchgear rooms. This system normally provides a mixture of outdoor air and recirculated air that is filtered by roughing and medium efficiency filters and is either heated or cooled. The control room outside air high efficiency filter trains are Seismic Category I and meet the single failure criterion. This specially filtered air is then mixed with the recirculated air to provide control room ventilation.

The control room air conditioning system has two normal modes of operation. The system can operate in a recirculation mode which will provide 1.2 air changes per hour. The system also has a fresh air (purge) mode which will provide six air changes per hour. The source of intake air is remote from potential contamination.

Control room air is recirculated through dust filters and heated or cooled as necessary to maintain comfortable working conditions. Power for the filtration recirculation system may be supplied from the emergency bus. The filtration recirculation system is Seismic Category I and is located in a Seismic Category I structure.

When normal plant and offsite power is unavailable, the emergency diesel generators will power system fans and will allow the water chillers to operate so they can maintain the control room at its design temperature described above. Airborne contamination is monitored to detect gross gamma radiation using a scintillation detector located just inside the inlet plenum. If high radiation is detected, automatic changeover takes place, causing the control room outside air supply to be passed through one of the high efficiency filter trains.

The control building heating, ventilation, and air conditioning performs functions that support fire protection.

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

The intended functions of the control building heating, ventilation, and air conditioning component types within the scope of license renewal include:

- control plant air temperatures to ensure operability of equipment in the control emergency switchgear, and battery rooms
- maintenance of nonsafety-related SSCs whose failure could prevent against adverse physical interaction that could cause safety-related SSC failure

2.3.3.6.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.6 and UFSAR Sections 6.4, 6.5, and 9.4 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

During its review of LRA Section 2.3.3.6, the staff identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAI as discussed below.

In RAI 2.3.3.6-1, dated August 7, 2009, the staff requested that the applicant provide clarification for not listing component types for accumulator, pulsation damper, low pressure tank, housings for pulsation damper, blower/fan, and vacuum pump, drain pans, electrical heater housing, bolting, washers and nuts, filter housing, screens and strainers, housings for condenser, cooler, heating and cooling coils, pipe fittings, hoses, tubes, rupture disk, housings for positive pressure devices, fire damper housings, and damper housing in LRA Table 2.3.3-6; pulsation damper and blower/fan, casing for vacuum pump, drip pans, electrical heater housing, filter housing, housings for condenser, cooler, heating and cooling coils, housings for positive pressure devices, fire damper housings, and damper housings in LRA Table 3.3.2-6; and other component types for wall sealants in above LRA tables.

By letter dated September 3, 2009, the applicant provided an enclosure showing a correlation for component types listed in the tables of LRA Section 2.3. The component types listed in the tables of LRA Section 2.3 were the common component categories that were used in the license renewal database to group the components that are in-scope for license renewal.

Based on the correlation guidelines of the enclosure, the applicant clarified component types as follows:

- Component type “pressure vessel” in Table 2.3.3-6 is equivalent to “accumulator, pulsation damper, low pressure tank” in Table 3.3.2-6
- Component type “blower” in Table 2.3.3-6 is equivalent to “blower, compressor, fan, vacuum pump” in Table 3.3.2-6
- Component type “drip pans” in Table 2.3.3-6 is equivalent to “drain pans” in Table 3.3.2-6
- Component type “heater housing” in Table 2.3.3-6 is equivalent to “electrical resistance heater, heat trace line” in Table 3.3.2-6
- Component type “fasteners” in Table 2.3.3-6 is equivalent to the component type “fasteners, bolting, washers, nuts” shown in the line items of Table 3.3.2-6
- Component type “filters” in Table 2.3.3-6 is equivalent to “filter, screens, and strainer” in Table 3.3.2-6
- Housings for condenser, cooler, heating and cooling coils are included in component type “heat exchanger” in Table 2.3.3-6 and the equivalent component type “heat exchanger, condenser, cooler, fan coil” in Table 3.3.2-6
- Component type “piping” in Table 2.3.3-6 is equivalent to “pipe, pipe fittings, hoses, tubes, rupture disk” in Table 3.3.2-6
- Housing for positive pressure device is included in component type “pump casings” in Table 2.3.3-6 and the equivalent component type “pumps, positive pressure devices (except blowers)” in Table 3.3.2-6
- Fire damper housings are included in the component type “valve body” Table 2.3.3-11 and in the line item “valve, damper” in Table 3.3.2-11
- Damper housings are included in component type “valve body” in Table 2.3.3-6 and the equivalent component type “valve, damper” in table 3.3.2-6
- Wall sealants are evaluated in the civil/structural area as elastomers in LRA Sections 2.4 and 3.5 of the application.

Based on the above, the applicant concluded that a revision is not necessary for LRA Tables 2.3.3-6 and 3.3.2-6.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.6-1 acceptable because the applicant provided an acceptable correlation such that the component types are properly identified as within the scope of license renewal, and 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). Therefore, the staff’s concern described in RAI 2.3.3.6-1 is resolved.

2.3.3.6.3 Conclusion

The staff reviewed the LRA, UFSAR, 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 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 adequately identified the control building heating, ventilation, and air conditioning components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.7 Control Rod Drive System

2.3.3.7.1 Summary of Technical Information in the Application

LRA Section 2.3.3.7 describes the control rod drive (CRD) system, consisting of locking piston control drive mechanism and the control rod drive hydraulic system (including power supply and regulation, hydraulic control units, interconnecting piping, instrumentation and electrical controls). The control rod drive mechanism (drive) used for positioning the control rod in the reactor core is a double acting, mechanism latched, hydraulic cylinder using demineralized water as its operating fluid. The individual drives are mounted on the bottom head of the reactor pressure vessel. The drives are capable of inserting or withdrawing a control rod at a slow, controlled rate, in addition to providing rapid insertion when required.

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

The intended functions of the control rod drive system component types within the scope of license renewal include:

- The CRD system is required to rapidly insert withdrawn control rods into the core (scram) in response to automatic signals from RPS.
- Portions of the CRD system are connected to, and part of, the reactor coolant pressure boundary during plant operation.
- The CRD system control rod is designed to mitigate the consequences of a control rod drop accident by limiting the drop velocity of a control rod.

2.3.3.7.2 Conclusion

The staff reviewed the LRA, UFSAR, and drawings 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 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 adequately identified the control rod drive system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.8 Drywell Sumps

2.3.3.8.1 Summary of Technical Information in the Application

LRA Section 2.3.3.8 describes the drywell sumps, which monitors leakage collected in the floor drain and equipment drain sumps. The unidentified leakage is collected in the floor drain sump and consists of leakage from control rod drives, valve flanges or packing, floor drains, closed cooling water system, drywell air cooling unit condensate drains, and any leakage not collected in the drywell equipment drain sump. The identified leakage is collected in the equipment drain sump and consists of leakage from various expected leakage sources.

The drywell sumps contain safety-related components relied upon to remain functional during and following DBEs. In addition, the drywell sump performs functions that support ATWS, EQ, and SBO.

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

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

- provide primary containment isolation
- collect and transfer identified and unidentified drywell leakage to allow detection of reactor coolant system leakage
- maintenance of nonsafety-related SSCs whose failure could prevent against adverse physical interaction that could cause safety-related SSC failure

2.3.3.8.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.8, UFSAR Section 9.2.1.3, and the license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAI as discussed below.

In RAI 2.3.3.8-01, dated August 7, 2009, the staff noted license renewal drawing BECH-M137 <1>-LR(C-6 and F-6) shows flow element venturi casings (FE3708 and FE3707) within the scope of license renewal for 10 CFR 54.4(a)(2). Flow element venturi casings are not included in LRA Table 2.3.3-8 as a component type. The applicant was requested to provide additional information explaining why the flow element venturi casings are not included as a component type subject to an AMR in LRA Table 2.3.3-8.

In its response dated September 3, 2009, the applicant stated, “The component type instrumentation (Flow Element) included in Table 2.3.3-8 includes the flow element venturi casing.”

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.8-01 acceptable because the applicant stated the flow element venture casing is included in the component type ‘flow element’ listed in Table 2.3.3-8. Therefore, the staff’s concern described in RAI 2.3.3.8-01 is resolved.

2.3.3.8.3 Conclusion

The staff reviewed the LRA, UFSAR, RAI response, and applicable license renewal drawings 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 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 adequately identified the drywell sumps components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.9 Electrical Manhole Sump Pump

2.3.3.9.1 Summary of Technical Information in the Application

LRA Section 2.3.3.9 describes the electrical manhole sump pump system. The electrical manhole sump pumps remove excess water from the manhole sumps. Water is pumped from each manhole to the ground outside the manhole. The electrical manhole sump pump contains nonsafety-related SSCs that potentially could prevent the satisfactory accomplishment of safety-related SSCs:

- cooling water subsystem
- diesel engines
- fuel oil subsystem
- generators
- intake air and exhaust subsystem
- lube oil subsystem
- starting air subsystem

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

The intended functions of the electrical manhole sump pump component types within the scope of license renewal include:

- maintenance of nonsafety-related component structural and pressure boundary integrity against adverse physical interaction that could cause safety-related SSC failure

2.3.3.9.2 Conclusion

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

2.3.3.10 Emergency Service Water System

2.3.3.10.1 Summary of Technical Information in the Application

LRA Section 2.3.3.10 describes the emergency service water (ESW) system, which provides coolant for emergency equipment, using water from the Cedar River. The system consists of two independent and redundant trains, each supplied by one ESW pump taking suction from the RHR service water/ESW pits. Except for the emergency diesel generators, the emergency service water trains discharge to circulating water. ESW supplies the following components: emergency diesel generators, residual heat removal pump seal coolers, residual heat removal and core spray pump room cooling units, high pressure coolant injection room cooling units, reactor core isolation cooling room cooling units, control building chillers, core spray pump motor bearing coolers, RHR service water pump motor coolers, and heating and ventilation instrument air compressors.

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

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

- provide cooling water to essential safeguards equipment during and following a DBE
- provide safety-related supply of water to the fuel pool in the event of a loss fuel pool cooling
- maintenance of nonsafety-related component structural and pressure boundary integrity against adverse physical interaction that could cause safety-related SSC failure

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

2.3.3.10.2 Conclusion

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

2.3.3.11 Fire Protection System

2.3.3.11.1 Summary of Technical Information in the Application

LRA Section 2.3.3.11 describes the fire protection system. The fire protection system includes a fire loop header underground and distribution piping supplied by water from one diesel-driven and one motor-driven fire pump. The system has pressure maintained by a jockey pump.

Fire protection water is normally taken from the circulating water pit. The fire protection water and well water systems are cross connected so that when the circulating water pit is drained for maintenance, the fire protection system can be supplied water from the well water system. The general service water system can be cross connected to the fire protection system when the circulating water pit is in service. The jockey pump is supplied water from the well water system. Well water and general service water can be used as a compensatory measure for an inoperable fire suppression water supply and is not designed to automatically supply the required flow of water to the fire suppression system.

Sprinkler, deluge, and preaction systems have been provided to cover specific and area hazards. An automatic total flooding low-pressure carbon dioxide (CO_2) fire suppression system protects the cable spreading room. A Halon fire suppression system is provided in the plant computer room for property protection.

Several fire detection and signaling systems are provided that transmit alarm and supervisory signals to the control room or at a security alarm station. Supervisory signals are provided to indicate the locations of the affected areas or units. Fire and smoke detection systems generally do have backup power supplies. Fire detection systems for the charcoal filters and safety-related areas are equipped with backup power supplies. A Halon suppression system is provided in the plant computer room for property protection.

LRA Table 2.3.3-11 identifies the component types within the scope of license renewal and subject to an AMR.

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

- System components that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions.

- System components that are relied upon to demonstrate compliance with 10 CFR 50.48.

2.3.3.11.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.11 and UFSAR Section 9.2.5 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions 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 the requirements of 10 CFR 54.21(a)(1).

The staff also reviewed the following DAEC fire protection CLB documents listed in DAEC Operating License Condition 2.C(3): NRC fire protection SERs for DAEC, dated June 1, 1978, and February 10, 1981.

The staff's review of LRA Section 2.3.3.11 identified areas in which additional information was necessary to complete the review of the applicant’s scoping and screening results. The applicant responded to the staff’s RAI as discussed below.

In RAI 2.3.3.11-1 dated August 7, 2009, the staff stated that the following LRA drawings showed fire protection system components as out of scope (i.e., not colored in red): valve V33-0337 on drawing BECH-M133<3>-LR and valve V33-0769 and the floor drain of sprinkler system No. 6 in the radioactive waste boiler area on drawing BECH-M133<5>-LR.

The staff requested that the applicant verify whether the components listed above were within the scope of license renewal, in accordance with 10 CFR 54.4(a), and whether they were subject to an AMR, in accordance with 10 CFR 54.21(a)(1). The staff further requested that, if these components were excluded from the scope of license renewal and were not subject to an AMR, the applicant should provide justification for the exclusion.

In a letter dated September 3, 2009, the applicant responded to RAI 2.3.3.11-1 and stated:

> Valve V33-0337 provides isolation for the East Warehouse sprinkler system and hose station. The East Warehouse is located remotely from plant buildings housing safety related equipment and does not present a fire hazard to safety related equipment. Therefore it is not in the scope of license renewal. The branch connection to the main fire loop that supplies the East Warehouse sprinkler and hose stations has an upstream isolation valve V33-0238 located on drawing BECH-M133<1>-LR (E-5) that is subject to aging management review. Valve V33-0238 provides the capability to isolate the East Warehouse fire protection components from the portions of the fire protection system that are in scope and subject to aging management review. Therefore, valve V33-0337 is not in the scope of license renewal and is not subject to an AMR.
>
> Drain isolation V33-0769 and the floor drain for Sprinkler No. 6 protecting the radwaste boiler area do not support the fire protection function of Sprinkler No. 6. While these lines could contain water that could spray or leak, this sprinkler is located in an area that does not contain any safety related equipment. Therefore, valve V33-0769 and the drain piping are not in the scope of license renewal and are not subject to an AMR.

The staff reviewed the applicant’s response and found that, since the function of valve V33-0337 is not to isolate the East Warehouse fire protection components from the portions of the fire protection system that are subject to an AMR, then V33-0337 is not within the scope of license renewal and subject to an AMR. Furthermore, the staff concluded that, given the fact that valve V33-0769 and floor drain of sprinkler system No. 6 do not support the fire protection function of sprinkler No. 6, V33-0769 is not within the scope of license renewal and subject to an AMR. Based on its review, the staff finds the applicant's response to RAI 2.3.3.11-1 acceptable.

In RAI 2.3.3.11-2 dated August 7, 2009, the staff stated that seven sprinkler systems mentioned in Section 4.3.1.e, "Automatic Water Fire Suppression Systems," of the SER dated June 1, 1978, had not been identified in detail in LRA Section 2.3.3.11. The staff requested that the applicant identify the locations of these seven sprinkler systems on the drawings and verify whether these sprinkler systems were within the scope of license renewal, in accordance with 10 CFR 54.4(a), and whether they were subject to an AMR, in accordance with 10 CFR 54.21(a)(1). If any system was excluded from the scope of license renewal and was not subject to an AMR, the staff requested that the applicant provide justification for the exclusion.

In a letter dated September 3, 2009, the applicant responded to RAI 2.3.3.11-2 and stated:

> All of these sprinkler systems have been highlighted on license renewal drawing BECH-M133<5>-LR, indicating they are in the scope of license renewal and are subject to an AMR. The principal components are addressed in LRA Table 2.3.3-11 as component types Piping and Valve body.

Sprinkler System	Plant Location	Plant Equipment Protected	BECH-M133<5>-LR Coordinate
Sprinkler System 1	Turbine Building	Turbine Clean & Dirty Lube Oil Tanks	F-1
Sprinkler System 2	Turbine Building	Diesel Generator Day Tank 1T-37B	F-5
Sprinkler System 3	Turbine Building	Diesel Generator Day Tank 1T-37A	F-3
Sprinkler System 4	Turbine Building	Area Under the Turbine Building Operating Floor	D-1
Sprinkler System 5	Turbine Building	Plant Heating Boiler Room	D-2
Sprinkler System 6	Radwaste Building	Radwaste Baler Area	D-4
Sprinkler System 7	Pump House	Diesel Fire Pump Day Tank Room	D-5

The staff reviewed the applicant's response to RAI 2.3.3.11-2. The staff confirmed that the seven sprinkler systems on drawing BECH-M133<5>-LR are highlighted, indicating that they are within the scope of license renewal and subject to an AMR. Based on its review, the staff finds the applicant's response to RAI 2.3.3.11-2 acceptable.

In RAI 2.3.3.11-3 dated August 7, 2009, the staff requested that the applicant indicate on which drawing(s) the 10 hose stations 21, 22, 23, 24, 25, 26, 27, 28, 29, and 35 were located.

In a letter dated September 3, 2009, the applicant responded to RAI 2.3.3.11-3. The applicant provided a table listing the 10 hose stations, corresponding isolation valve numbers, and LRA drawing coordinates. The applicant stated:

The remaining 10 fire hose stations are also located on LRA drawing BECH-M133<3>-LR and are highlighted to indicate they are subject to an AMR. The stations are downstream of the following hose station isolation valves at the indicated drawing coordinates:

Hose Station Number	Isolation Valve	BECH-M133‹3›-LR Coordinate
21	V33-0474	B-5
22	V33-0506	C-5
23	V33-0507	B-5
24	V33-0494	F-5
25	V33-0469	B-6
26	V33-0496	B-6
27	V33-0495	C-6
28	V33-0515	C-6
29	V33-0465	C-6
35	V33-0484	F-5

The staff reviewed the applicant’s response to RAI 2.3.3.11-3. The staff located the 10 hose stations 21, 22, 23, 24, 25, 26, 27, 28, 29, and 35 at the following coordinates of LRA drawing BECH-M133<3>-LR respectively: B-5, C-5, B-5, F-5, B-6, B-6, C-6, C-6, C-6, and F-5. Based on its review, the staff finds the applicant’s response to RAI 2.3.3.11-3 acceptable.

In RAI 2.3.3.11-4 dated August 7, 2009, the staff stated that Section 3.2.4, “Control Room Fire Hazards,” of the DAEC SER supplement, dated February 10, 1981, states that, “Other proposed modifications for the control room area include: upgrading the glass partition wall between the computer room and the control room to minimum one-hour fire-rated design…” The glass partition in LRA Section 2.3.3.11 or in the LRA drawings is apparently not within the scope of the license renewal and not subject to an AMR. The staff requested that the applicant verify whether the upgraded glass partition wall between the computer room and the control room is within the scope of license renewal, in accordance with 10 CFR 54.4(a), and whether it is subject to an AMR, in accordance with 10 CFR 54.21(a)(1). If it is excluded from the scope of license renewal and is not subject to an AMR, the staff requested that the applicant provide justification for the exclusion.

In a letter dated September 3, 2009, the applicant responded to RAI 2.3.3.11-4 and stated:

> The DAEC current licensing basis for Fire Protection includes the Control Room Complex, the Cable Spreading Room located below the Control Room, and the Control Building HVAC Room located above the Control Room as parts of one Fire Area (Fire Area CB1). Fire Areas are defined as areas of the plant that are separated by fire barriers. The upgraded wire-embedded glass partition between the Control Room office area and the Control Room front panel area, and the wall constructed with gypsum board that separates the Control Room computer area from the Control Room front panel area, are smoke and heat resistant partitions and not rated fire barriers that separate fire areas. Therefore, these partitions are not in the scope of license renewal and are not subject to an AMR.

The staff reviewed the applicant’s response to RAI 2.3.3.11-4 and determined that the applicant’s response did not address the staff’s question about the fire rating of the glass partition between the computer room office area and the control room front panel area. In order to resolve the staff's concerns about the glass partition, the staff held a conference call with the applicant on November 12, 2009. During this conference call, the staff asked the applicant to provide additional information about the glass partition fire rating.

In a letter dated December 14, 2009, the applicant stated:

> RAI 2.3.3.11-4 raised a question about a glass partition between the computer room and the control room that had been mentioned in a 1981 NRC safety evaluation report. In the response to RAI 2.3.3.11-4 (letter NG-09-0646 dated 9/3/09), DAEC indicated that a wall constructed with gypsum board separated the Control Room computer area and the Control Room front panel area, and that the wall was a heat resistant partition and not a fire barrier that separated fire areas.
>
> The response to RAI 2.3.3.11-4 is clarified to indicate that the gypsum wall was constructed instead of a glass partition. This wall was constructed with a one hour fire rating.

The staff reviewed the applicant's additional information provided in the December 14, 2009, letter and determined that the applicant's response did not specify whether the glass partition and the one-hour fire-rated gypsum wall were 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).

In order to address the staff's additional concerns about the glass partition and the gypsum wall, the staff held a conference call with the applicant on January 12, 2010. During this conference call, the staff asked the applicant to provide additional information about the glass partition and the gypsum wall.

In a letter dated February 2, 2010, the applicant stated:

> DAEC agreed to revise the LRA to include the gypsum wall and glass partition in scope of license renewal and to provide the results of an aging management review. Therefore, the LRA is revised as follows:
>
> > In LRA Section 3.5.1.2, Control Building, the following bullets are added under "Materials:"
> >
> > - Gypsum
> > - Glass
>
> In the Notes for Tables 3.5.2-1 through 3.5.2-11, under Plant-Specific Notes, on page 3.5-127, a new Note 515 is added to read as follows: 515. Gypsum is used as a 1 hour fire rated partition between the control room computer room and control panel areas. The partition is inspected by fire protection personnel.
>
> In Table 3.5.2-2, "Summary of Aging Management Review Results, Control Building," the following line entries are added for "Control room 1 hour fire rated smoke and heat partition wall" and "Control room wire embedded glass smoke and heat partition wall."

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 line item	Table 3.X.1 item	Notes
Control room 1 hour fire-rated smoke and heat partition wall	Fire Barrier	Gypsum	Air-indoor controlled (exterior)	Cracking	Fire Protection Program			515, J
Control room wire embedded glass smoke and heat partition wall	Fire Barrier	Glass	Air-indoor controlled (exterior)	None	None	VII.J-8 (AP-14)	3.3.1-93	C

In LRA Appendix A, Section 18.4, Duane Arnold License Renewal Commitments, a new license renewal commitment number 49 is also provided, as follows:

Item No.	System Component or Program	Commitment	Section	Schedule
49.	Fire Protection Program	Enhance procedures to inspect the 1 hour fire-rated gypsum board wall that separates the control room computer room area from the front panel area for aging due to cracking.	18.1.22	Prior to the period of extended operation

The staff reviewed the applicant's response to RAI 2.3.3.11-4 dated February 2, 2010. Based on the fact that the applicant has included the gypsum wall and the glass partition within the scope of license renewal, as required by 10 CFR 54.4(a), and provided the results of an AMR, as required by 10 CFR 54.21(a)(1), the staff finds the applicant's response to RAI 2.3.3.11-4 acceptable.

In RAI 2.3.3.11-5 dated August 7, 2009, the staff requested that the applicant explain why trash racks and traveling screens had been excluded from the scope of license renewal. The staff quoted Section 4.3.1, "Water Systems," of the SER dated June 1, 1978, that states:

> Fire water is obtained from a common wet pit in the pump houses which is supplied from the Cedar River and the cooling tower basins. The 400,000 gallon capacity wet pit cooling tower basin [is] supplied by four 6,000 gpm pumps taking suction from the Cedar River. Water is released from a reservoir to maintain the river at an acceptable water level. The wet pit has adequate capacity to meet the requirement of the fire water system.

The staff also stated that LRA Section 2.3.3.11 discusses requirements for the fire water supply system but does not mention trash racks and traveling screens for the fire pump suction water supply. Typically, trash racks and traveling screens are located upstream of the fire pump suction and are 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 in a water/air environment is subject to loss of material, pitting, crevice formation, and microbiologically-influenced corrosion and fouling.

In a letter dated September 3, 2009, the applicant responded to RAI 2.3.3.11-5 and stated:

The river water supply intake traveling screens are safety related components with an intended function to remove debris from the water supply to the safety related emergency service water and residual heat removal service water pumps. As discussed in LRA Section 2.3.3.16, Intake and Traveling Screens, the river water supply traveling screens are in the scope of license renewal and are subject to an AMR. The river water supply trash racks are located upstream of the traveling screens and provide a non safety related function to minimize the potential for large debris from entering the traveling screen bays. However, the trash racks are not required to filter out postulated river water debris in order to enable the traveling screens to perform their function.

A search of DAEC operating experience identified no previous history of aging or damage to the intake structure trash racks. As a preventive measure, the racks were removed and coated with an anti-fouling coating in 1996 after approximately 25 years of operation. The racks were found to be in excellent condition.

A search of industry operating experience did identify plants that had incurred damage to their intake trash racks. One plant identified debris that had entered its intake structure after a portion of the trash racks had corroded and failed. Another plant had a failure of a trash rack due to high differential pressure from the accumulation of gracilaria on the bottom of the rack. Both of these plants had trash racks that were exposed to a harsh sea water environment. In addition, both of these plants had high rate flow from circulating water drawn through the trash racks. The high flow rates at those plants would result in a greater potential for debris to be entrained and carried to the trash racks than would be experienced at the low flow rates through the trash racks at DAEC.

The DAEC trash racks are exposed to river water and atmosphere environments and pass water at relatively low flow rates, either to make up for cooling tower evaporation and drift or to supply the Emergency Service Water and Residual Heat Removal Service Water Systems during emergency conditions. The required flow for emergency service water and residual heat removal service water is provided by one river water supply pump per train. The flow rate of 6000 gallons per minute would provide an approach velocity to each traveling screen of only approximately 0.375 feet per minute at minimum river levels. One river water supply pump can also provide the rated flow of both installed fire pumps in the unlikely event additional water volume is needed beyond the wet pit. The low approach velocity at the required intake flow rate minimizes the potential for large debris to be drawn into the river water intake and ensures that even a hypothetical failure of a trash rack would not impair the operation of the downstream safety related river water supply traveling screens.

Therefore, the non-safety related trash racks do not provide a license renewal intended function as defined in 10 CFR 54.4(a)(1), (a)(2) or (a)(3), and are not subject to [an] aging management review.

The staff reviewed the applicant’s response to RAI 2.3.3.11-5. In its response, the applicant confirmed that the water supply intake traveling screens are within the scope of license renewal and subject to an AMR. In regard to the trash racks, the applicant searched industry operating experience data and found that the intake trash racks that had incurred damage were exposed to a harsh sea water environment and high rate flow from circulating water drawn through the trash racks. The applicant stated that the DAEC trash racks are exposed to river water and atmosphere environments and pass water at relatively low flow rates. The applicant further stated that the low approach velocity at the required intake flow rate minimizes the potential for large debris to be drawn into the river water intake and ensures that even a hypothetical failure of a trash rack would not impair the operation of the downstream safety-related river water supply traveling screens. Based on its review, the staff finds the applicant's response to RAI 2.3.3.11-5 acceptable.

In RAI 2.3.3.11-6 dated August 7, 2009, the staff requested that the applicant determine whether LRA Tables 2.3.3-11 and 3.3.2-11 should include the following fire protection components that appear in the SER dated June 1, 1978: hose stations; hose connections; hose racks; pipe supports; couplings; tubing; tank(s); fire hydrants (casing); sprinkler heads; nozzles; passive components in diesel engines for fire water pumps; fire retardant coating for structural steel; dikes and curbs for oil spill confinement. If the applicant determined that LRA Tables 2.3.3-11 and 3.3.2-11 should not include these components, the staff requested that the applicant provide justification for the exclusion of these components from the scope of license renewal.

In a letter dated September 3, 2009, the applicant stated:

> The listed components are included in the DAEC LRA tables and are subject to an AMR. The components were grouped with standardized generic component types such as pipe, accumulator, heat exchanger and structure. Most of the components are addressed in LRA Tables 2.3.3-11 and 3.3.2-11. Some, however, were evaluated as civil/structural components, and are addressed in the civil/structural tables of the LRA.
>
> The following table lists the generic component type grouping with which each listed component was evaluated and identifies the terminology used to identify the components in the various LRA tables.

Component	Component Type Grouping	LRA 2.3/2.4 Table Listing	LRA 3.3/3.4 Table Listing
Hose Stations	Pipe	Piping (2.3.3-11)	Pipe, pipe fittings, hoses, tubes rupture discs (3.3.2-11)
Hose Connection	Pipe	Piping (2.3.3-11)	Pipe, pipe fittings, hoses, tubes rupture discs (3.3.2-11)
Hose Racks and Pipe Supports	Support	Fasteners, spring hangers, guides, stops, supports, new fuel storage racks, panels, carbon steel air-indoor uncontrolled (2.4-10)	Non-ASME Support (3.5.2-10)
Couplings	Pipe	Piping (2.3.3-11)	Pipe, pipe fittings, hoses, tubes rupture discs (3.3.2-11)
Tubing	Pipe	Piping (2.3.3-11)	Pipe, pipe fittings, hoses, tubes rupture discs (3.3.2-11)

Component	Component Type Grouping	LRA 2.3/2.4 Table Listing	LRA 3.3/3.4 Table Listing
Tanks	Accumulator	Pressured Vessel (2.3.3-11)	Accumulator, pulsation damper, low pressure tank (3.3.2-11)

Fire Hydrant Casings	Pipe	Piping (2.3.3-11)	Pipe, pipe fittings, hoses, tubes rupture discs (3.3.2-11)
	Valve	Valve Body	Valve damper (3.3.2-11)
Sprinkler Heads	Pipe	Piping (2.3.3-11)	Pipe, pipe fittings, hoses, tubes rupture discs (3.3.2-11)
Nozzles	Pipe	Piping (2.3.3-11)	Pipe, pipe fittings, hoses, tubes rupture discs (3.3.2-11)
Passive Components in Diesel Engines for Fire Water Pumps	Heat Exchanger	Heat Exchanger (2.3.3-11)	Heat exchanger, condenser, cooler, fan (3.3.2-11)
	Pipe	Piping (2.3.3-11)	Heat exchanger, condenser, cooler, fan (3.3.2-11)
Fire Retardant Coating for Structural Steel	Structure	Structural steel fire proofing air-indoor uncontrolled (2.4.2)	Structural steel fireproofing (3.5.2.2)
	Structure	Structural steel fire proofing air-indoor uncontrolled (2.4.2)	Structural steel fireproofing (3.5.2.2)
Dikes and Curbs for Oil Spill Confinement	Structure	Concrete air-indoor uncontrolled (2.4-2)	Concrete (3.5.2-2)
	Structure	Concrete air-indoor uncontrolled (2.4-2)	Concrete (3.5.2-2)
	Structure	Concrete air-indoor uncontrolled (2.4-2)	Concrete (3.5.2-2)
	Structure	Concrete air-indoor uncontrolled (2.4-2)	Concrete (3.5.2-2)

In its response, the applicant grouped as “Pipes” the following eight components: hose stations, hose connections, couplings, tubing, fire hydrant casing (pipe portion), sprinkler heads, nozzles, and the passive components in diesel engines for fire water pumps (pipe portion). The applicant stated that these eight components were listed in LRA Table 2.3.3-11 under “Piping,” and in LRA Table 3.3.2-11 under “Pipe, pipe fittings, hoses, tubes, rupture disks.”

The applicant grouped the hose racks and pipe supports as “Support,” and listed the hose racks and pipe supports in LRA Table 2.4-10 under “Fasteners, spring hangers, guides, stops, supports, new fuel storage racks, panels, carbon steel air-indoor controlled.” Hose racks and pipe supports are listed as non-ASME support in LRA Table 3.5.2-10.

The applicant grouped the tanks as “Accumulator,” and listed the tanks in LRA Table 2.3.3-11 under “Pressure vessel” and in LRA Table 3.3.2-11 under “Accumulator, pulsation damper, low pressure tank.”

The applicant grouped the valve portion of the fire hydrant casing as “Valve” and listed that component in LRA Table 2.2.3-11 under “Valve body” and in LRA Table 3.3.2-11 under “Valve damper.”

The applicant grouped the passive components in diesel engines for fire water pumps (heat exchanger portion) as “Heat exchanger” and listed these components in LRA Table 2.3.3-11 under “Heat exchanger” and in LRA Table 3.3.2-11 under “Heat exchanger, condenser, cooler, fan.”

The applicant grouped the fire retardant coating for structural steel as “Structure” and listed this component in LRA Table 2.4.2 under “Structural steel fire proofing air-indoor uncontrolled” and in LRA Table 3.5.2.2 under “Structural steel fireproofing.”

Finally, the applicant grouped dikes and curbs for oil spill confinement as “Structure” and listed that component in LRA Tables 2.4-2, 2.4-8. 2.4-9, and 2.4-11 under “Concrete air-indoor uncontrolled” and in LRA Tables 3.5.2-1, 3.5.2-8, 3.5.2-9, and 3.5.2-11 under “Concrete.”

The staff reviewed the applicant’s response to RAI 2.3.3.11-6. The staff confirmed that the components listed in RAI 2.3.3.11-6 dated August 7, 2009, were included in the table provided by the applicant in its response to RAI 2.3.3.11-6. Based on its review, the staff finds the applicant’s response to RAI 2.3.3.11-6 acceptable because the applicant has addressed and resolved each item in RAI 2.3.3.11-6 as discussed above.

2.3.3.11.3 Conclusion

The staff reviewed the LRA, UFSAR, RAI responses, and license renewal drawings to determine whether the applicant properly identified all fire protection system components within the scope of license renewal. In addition, the staff sought to determine whether 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 adequately identified the fire protection 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 Fuel Pool Cooling and Cleanup System

2.3.3.12.1 Summary of Technical Information in the Application

LRA Section 2.3.3.12 describes the fuel pool cooling and cleanup system, which maintains a fuel pool water temperature at a level that will prevent damage to the fuel elements. The system removes the decay heat from the fuel assemblies and maintains fuel pool water temperature for spent fuel storage and refueling operations and prevents damage to the fuel elements caused by overheating.

Fuel pool cooling and cleanup minimizes corrosion product buildup and controls water clarity, minimizes fission product concentration in the water that could be released from the pool to the reactor building environment, monitors fuel pool water level, and maintains a water level above the fuel sufficient to provide shielding for normal building occupancy. Fuel pool cooling and cleanup cools the fuel storage pool by transferring the spent fuel decay heat through a heat exchanger to reactor building closed cooling water. A system cross-tie allows well water to augment the general service water cooling for the reactor building closed cooling water system during general service water out-of-service windows during refuel outages. Water purity and clarity in the storage pool, reactor well, and dryer-separator storage pit are maintained by filtering and demineralizing the pool water through a filter-demineralizer.

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

The intended function of the fuel pool cooling and cleanup system component type within the scope of license renewal is maintenance of nonsafety-related component structural and pressure boundary integrity against adverse physical interaction that could cause safety-related SSC failure. The system contains components credited in the CLB for fire protection.

2.3.3.12.2 Conclusion

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

2.3.3.13 General Service Water System

2.3.3.13.1 Summary of Technical Information in the Application

LRA Section 2.3.3.13 describes the general service water system, which provides water to meet cooling requirements of the reactor building closed cooling water and equipment in the turbine building. The system contains three pumps located in the service water system pumphouse that take suction from the same wet-pit as the circulating water pumps. The pumps discharge to a common header for distribution to plant equipment. The outlets of the plant equipment are combined and returned to the circulating water wet-pit after being cooled by passage through the cooling towers. General service water provides cooling to the following equipment: isophase bus duct cooler, generator hydrogen coolers, stator winding liquid coolers, condensate pump motor coolers, exciter air cooler, turbine lube oil coolers, oil and motor coolers for reactor feed pumps, electro-hydraulic control system coolers, recirc pump motor generator set coolers, reactor building closed cooling water heat exchangers, chlorination system, circulating water pump motor coolers, and the steam tunnel cooling units.

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

The intended function of the general service water system component type within the scope of license renewal is maintenance of nonsafety-related component structural and pressure boundary integrity against adverse physical interaction that could cause safety-related SSC failure.

2.3.3.13.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.13 and UFSAR Section 9.2.4 and the 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 FSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

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 2.3.3.13-01, dated August 7, 2009, the staff noted license renewal drawing BECH-M111-LR (E-8) upstream of radiation element RE-4767, shows a 3-inch line as not within scope for license renewal. This line is directly connected to a 12-inch-JBD-11 line that is within the scope of license renewal. The applicant was requested to provide additional information explaining why the 3-inch line is not within the scope of license renewal and justify the boundary location with respect to the applicable requirements of 10 CFR 54.4(a).

In its response dated September 3, 2009, the applicant stated that the 3-inch line is welded to the side of the 12-inch line, does not penetrate the 12-inch pipe or provide a pressure or leakage boundary.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.13-01 acceptable because the applicant clarified that the 3-inch line does not provide a pressure or leakage boundary. Therefore, the staff's concern described in RAI 2.3.3.13-01 is resolved.

In RAI 2.3.3.13-02, dated August 7, 2009, the staff noted license renewal drawing BECH-M146-LR (A-2, A-3, and A-4) shows three service water pump casings as in-scope for license renewal for 10 CFR 54.4(a)(2). The components XJ4937A, XJ4937B and XJ4937C attached to the pump casings are shown as not in-scope for license renewal. The applicant was requested to provide additional information explaining the function and component type for XJ4937A, XJ4937B and XJ4937C and why these components are not within the scope of license renewal.

In its response dated September 3, 2009, the applicant stated the components are expansion joints providing a leakage boundary and are within scope, but are on a periodic replacement schedule and therefore are not subjected to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.13-02 acceptable because the applicant clarified the scoping classification and functions of the components in question. Therefore, the staff's concern described in RAI 2.3.3.13-02 is resolved.

2.3.3.13.3 Conclusion

The staff reviewed the LRA, UFSAR, RAI responses, and applicable license renewal drawings 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 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 adequately identified the general service water system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.14 Hydrogen Water Chemistry System

2.3.3.14.1 Summary of Technical Information in the Application

LRA Section 2.3.3.14 describes the hydrogen water chemistry system. The system supplies hydrogen for injection into the feedpump suction and for main generator makeup and purge requirements. The system supplies the off-gas exhaust system with air or oxygen to ensure a stoichiometric mixture for recombination of hydrogen and oxygen, and injects oxygen into the suction of the condensate pumps to maintain oxygen levels sufficiently high to minimize corrosion. The hydrogen water chemistry system includes the crack arrest verification system.

This system takes a sample from the reactor recirculation sample line. The system provides online monitoring (crack growth) of pre-cracked, stressed, fractured mechanics test specimens made from boiling water reactor structural materials. Other components at the crack arrest verification system location measure the chemical and electrochemical properties of the reactor coolant.

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

The intended function of the hydrogen water chemistry system component type within the scope of license renewal is maintenance of nonsafety-related SSCs that could prevent against adverse physical interaction that could cause safety-related SSC failure.

2.3.3.14.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.14, UFSAR Section 9.3.5 and the license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

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 2.3.3.14-01, dated August 7, 2009, the staff noted license renewal drawing BECH-M189<2>-LR (A-3), shows a line from a compressed oxygen bottle penetrating the oxygenated water tank. The water tank is shown within the scope of license renewal per 10 CFR 54.4(a)(2); however, the line from the oxygen bottle is not within scope. The applicant was requested to provide additional information explaining why the oxygen line and associated penetration is not within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2).

In its response dated September 3, 2009, the applicant stated:

> The oxygen line and oxygenated water tank are part of 1C502 which is a test panel constructed for hydrogen water chemistry. The oxygen bottle is isolated by an instrument air valve which is not shown on the drawing. This stainless steel tubing from the oxygenated water tank up to and including the valve at the oxygen bottle is in scope and subject to an AMR and should be colored green.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.14-01 acceptable because the applicant properly identified the components that should be highlighted as within the scope of license renewal, in accordance with 10 CFR 54.4(a)(2). Therefore, the staff's concern described in RAI 2.3.3.14-01 is resolved.

In RAI 2.3.3.14-02, dated August 7, 2009, the staff noted license renewal drawing BECHM189<1>-LR (E-2) shows a ½-inch line, CCD-2, and the associated check valve V89-0052 within the scope of license renewal per 10 CFR 54.4(a)(2). The license renewal boundary is shown to be at the check valve. The continuation of line CCD-2, upstream of the check valve, is shown as not within the scope of license renewal. The applicant was requested to provide additional information explaining why the continuation of the ½-inch line CCD-2 upstream of the check valve V89-0052 is not within scope for license renewal.

In its response dated September 3, 2009, the applicant stated the check valves V89-0049 and V89-0052 provide the boundary between feedwater pressure and hydrogen gas pressure. The piping upstream of these check valves is gas filled and is not within scope for license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.14-02 acceptable because the applicant defined the license renewal boundary and provided justification for the continuation of ½-inch CCD-2 for not being within the scope of license renewal. Therefore, the staff's concern described in RAI 2.3.3.14-02 is resolved.

2.3.3.14.3 Conclusion

The staff reviewed the LRA, UFSAR, RAI responses, and applicable license renewal drawings 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 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 adequately identified the hydrogen water chemistry 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).

2.3.3.15 Instrument Air System

2.3.3.15.1 Summary of Technical Information in the Application

LRA Section 2.3.3.15 describes the instrument air system. The instrument air is provided by three motor-driven, oil-free compressors located in the air compressor building. A fourth oil-free compressor located in the turbine building basement is used as a standby compressor. Instrument air then passes through an air dryer and a filter before entering the instrument air header that feeds the instrument components. There is a standby air dryer and filter which can be used for maintenance purposes.

Should loss of air system header pressure occur, successive header isolations will result. Also air accumulators or high pressure storage bottles have been provided locally for critical components of the condensate and feedwater system. This backup air system will allow the feedwater system to control reactor water level for a brief period after a loss of instrument air. Instrument air system is not safety-related. Although the normal instrument air system supplies some safety-related equipment, total failure of the system will not adversely affect the operation of the plant. The safety-related air system can supply air to support the operation of safety-related equipment if the instrument air system becomes unavailable. Breathing air is contained in six-man stations located throughout the power block. Breathing air is cross-tied to the instrument air. When necessary, breathing air for personnel use can be obtained from the instrument air mains or service air mains. The breathing air connection to the drywell has a removable spool piece inside the drywell, a blank flange which is installed on the air supply line in the drywell and an isolation valve outside the containment.

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

The intended function of the instrument air system component type within the scope of license renewal is to provide containment isolation and maintenance to nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of a safety-related function due to spatial proximity.

2.3.3.15.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.15, UFSAR Section 9.3.1 and the applicable license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant 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 the requirements of 10 CFR 54.21(a)(1).

The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAI as discussed below.

In RAI 2.3.3.15-01, dated August 7, 2009, the staff noted license renewal drawing BECH-M173-LR (B-7) shows valve SV7334B as not within scope for license renewal. The applicant was requested to provide additional information explaining why valve SV7334B is not within scope.

In its response dated September 3, 2009, the applicant stated that the drawing incorrectly omitted valve SV7334B and is within the scope of license renewal and subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.815-01 acceptable because the applicant stated valve SV7334B is within scope and subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.15-01 is resolved.

2.3.3.15.3 Conclusion

The staff reviewed the LRA, UFSAR, RAI response, and applicable license renewal drawings to determine whether or not the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions that were not corrected. In addition, the staff's review determined if 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 adequately identified the instrument air 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).

2.3.3.16 Intake and Traveling Screens

2.3.3.16.1 Summary of Technical Information in the Application

LRA Section 2.3.3.16 describes the intake and traveling screen system, which provides water supply for various systems and removes any debris accumulated on the bar racks.

The safety-related water supply systems (river water supply, RHR service water, and emergency service water systems) is located on the west bank of the Cedar River. Water diverted to the intake structure passes through bar racks to two parallel intake channels . At the inlet end of each channel, water passes through traveling screens into two separate pump wet pits. Each pit contains two vertical river water pumps.

A trash rack is provided on the outdoor deck of the intake structure to remove any debris accumulated on the bar racks. The traveling screen in each pump wet well pit channel is operated individually. Each screen is supplied with wash water by a screen wash pump that takes its supply from the main header.

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

The intended function of the intake and traveling screen system component type within the scope of license renewal is to provide maintenance on nonsafety-related SSCs whose failure could prevent satisfactory accomplishment of a safety-related function due to spatial proximity.

2.3.3.16.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.16, UFSAR Section 9.2.2 and the applicable license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAI as discussed below.

In RAI 2.3.3.16-01, dated August 7, 2009, the staff noted license renewal drawing BECH-M129-LR (D-2 and D-8) shows strainers (1S-85A and B) within scope for 10 CFR 54.4(a)(2). Strainers are not included in the list of component types in LRA Table 2.3.3-16. The applicant was requested to provide additional information explaining why strainers are not included as a component type subject to an AMR in LRA Table 2.3.3-16.

In its response dated September 3, 2009, the applicant stated the component type “filter” in LRA Table 2.3.3-16 includes the intake traveling screen wash pump suction strainers.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.16-01 acceptable because the applicant stated the component type “filter” in LRA Table 2.3.3-16 includes the intake traveling screen wash pump suction strainers. Therefore, the staff’s concern described in RAI 2.3.3.16-01 is resolved.

2.3.3.16.3 Conclusion

The staff reviewed the LRA, UFSAR, RAI response, and applicable license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal.

The staff finds no such omissions. In addition, the staff’s review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant adequately identified the intake and traveling screens 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).

2.3.3.17 Off-Gas Exhaust System

2.3.3.17.1 Summary of Technical Information in the Application

LRA Section 2.3.3.17 describes the off-gas exhaust system, which includes three systems: (1) the off-gas recombiner, (2) off-gas exhaust, and (3) radiation monitoring system.

The off-gas exhaust system collects gaseous discharges from the main condenser air ejectors and gland seal condenser. The system processes and delivers the gases to the main stack for elevated releases to the atmosphere. The system is designed so that any quantities of gaseous radioactivity inadvertently released will not exceed the exposure limits of 10 CFR 20. The off-gas recombiner system uses a high temperature catalytic recombiner to recombine radiolytically dissociated hydrogen and oxygen from the air ejectors. After chilling to strip the condensibles and reduce the volume, the remaining noncondensibles are delayed in a 30-minute holdup system, cooled with a chilled glycol cooler, passed through a de-entrainer, heated, and passed through a high efficiency particulate absorber (HEPA) filter before reaching the absorption bed. The delay on the charcoal allows the xenon and krypton to decay in place. The gas effluent passes through a high efficiency after-filter and proceeds to the elevated release point.

The radiation monitoring system consists of several subsystems which provide continuous monitoring of area radiation levels, and radiation levels of liquid and gaseous processes throughout the plant which can release activity directly to the environment. The radiation monitoring systems within the scope of license renewal are main steam supply line radiation monitoring, reactor building exhaust radiation monitoring, and control building ventilation radiation monitoring.

The main steam supply line radiation monitoring system monitors the radiation level in the main steam lines for gross release of fission products from the fuel. The system consists of four gamma radiation detectors mounted in the steam tunnel to provide indications, alarms, and input to the nuclear steam supply shutoff system. The main steam supply line radiation monitors are in the scope of license renewal.

The reactor building exhaust radiation monitoring system consists of the reactor building ventilation exhaust plenum radiation monitors and the refuel pool ventilation exhaust radiation monitors. Both systems initiate control action to prevent release of radioactive material to the environs. The reactor building exhaust radiation monitors are in-scope of license renewal.

The control building ventilation radiation monitoring system monitors the radioactivity level of the outside air being drawn into the control building, indicates whenever abnormal amounts of radiation are present, and initiates control action to limit the amount of radioactive material drawn into the control building. The control building ventilation radiation monitors are within the scope of license renewal.

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

The intended functions of the off-gas exhaust system component types within the scope of license renewal include:

- process and deliver gases to main stack for release
- provide isolation signal to nuclear steam supply system (NSSS) components
- maintenance of nonsafety-related component against adverse physical interaction that could cause safety-related SSC failure

2.3.3.17.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.17, UFSAR Sections 1.2, 1.2.5.4.3, 11.3, and 11.5, and the applicable license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3. During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant has not omitted from the scope of license renewal any components with intended functions delineated under 10 CFR 54.4(a). The staff then reviewed those components that the applicant identified as within the scope of license renewal to verify that the applicant has not omitted any passive and long-lived components subject to an AMR, in accordance with the requirements of 10 CFR 54.21(a)(1).

The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAI as discussed below.

In RAI 2.3.3.17-01, dated August 7, 2009, the staff noted license renewal drawing BECHM105<1>-LR (F-6) shows a section of piping (3-inch-EBD-5) continued to drawing BECH-149-LR (C-8). License renewal note 2 states that, "a portion of this pipe runs through a room(s) that contains safety-related components and would be in-scope for license renewal." However, review of drawing BECH-149-LR (C-8) found that the continuation (3-inch-EBD-5) is not included within scope for license renewal. The applicant was requested to provide additional information explaining why the continuation on BECH-149-LR (C-8) is not within the scope of license renewal.

In its response dated September 3, 2009, the applicant stated that on drawing BECH-M149-LR, a portion of line 3-inch-EBD-5 should be shown in green with a note similar to note 2 on BECH-M105-<1>-LR. This portion of 3-inch-EBD-5 is within the scope of license renewal as it passes through the room containing safety-related components.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.17-01 acceptable because the applicant identified that the continuation of pipe section 3-inch-EBD-5 that passes through the room containing safety-related components is within the scope of license renewal. Therefore, the staff's concern described in RAI 2.3.3.17-01 is resolved.

2.3.3.17.3 Conclusion

The staff reviewed the LRA, UFSAR, RAI response, and applicable license renewal drawings 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 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 adequately identified the off-gas exhaust 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).

2.3.3.18 Plant Ventilation

2.3.3.18.1 Summary of Technical Information in the Application

LRA Section 2.3.3.18 describes the plant ventilation system, which includes five systems: (1) the intake structure heating, ventilation, and air conditioning, (2) pump house structure heating, ventilation, and air conditioning, (3) standby diesel generator rooms heating, ventilation, and air conditioning, (4) turbine building heating, ventilation, and air conditioning, and (5) radwaste building heating, ventilation, and air conditioning.

Plant ventilation systems control air temperature to support equipment located in the buildings and allows smoke and heat ventilation in the event of a fire.

The intake structure heating, ventilation, and air conditioning system provides heating and forced air ventilation to the intake structure to maintain acceptable environmental conditions to support fire protection.

The pump rooms that house the RHR service water pumps and the emergency service water pumps are provided with ventilation supply and exhaust systems. Heating is provided for equipment and freezing pipe protection. Supply fans introduce filtered air through roughing and medium efficiency filters to remove excessive heat generated by equipment. The air is mostly recirculated and is tempered by mixing return air with outdoor air to maintain design temperature. When a supply fan operates, the exhaust louvers automatically open.

The standby diesel generator room's heating, ventilation, and air conditioning system provides ventilation. Each standby diesel generator room is provided with a ventilation air supply fan and a suitable means of exhaust. The ventilation system is supplied with standby power during a loss of offsite power.

The turbine building is ventilated by a once-through system consisting of one supply subsystem and three distinct exhaust subsystems. Supply air is drawn through the main plant intake coils by three supply fans located in the reactor building equipment room. Air is exhausted from the operating floor by way of eight roof exhaust ducts which are connected to three exhaust fans via a common header. The turbine building exhaust is mixed with air from other plant areas and then discharged to the environs via the main plant ventilation stack by three exhaust fans.

The radwaste building is served by ventilating systems, one for the radwaste control room and one for the radwaste area and equipment room. The radwaste control room unit supplies the room with a mixture of outdoor air and recirculated air. The radwaste area is exhausted by two redundant exhaust fan units, each of which consists of a fan, prefilters, HEPA filters to the space surrounding the torus, which is used as the reactor building exhaust plenum.

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

The intended functions of the process and area radiation monitoring system component types within the scope of license renewal include:

- provide cooling for each standby diesel-generator room
- provide cooling for the safety-related equipment in the intake structure
- maintenance of nonsafety-related component structural and pressure boundary integrity against adverse physical interaction that could cause safety-related SSC failure

2.3.3.18.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.18 and UFSAR Sections 9.4 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

During its review of LRA Section 2.3.3.18, the staff identified area(s) in which additional information was necessary to complete the review of the applicant’s scoping and screening results. The applicant responded to the staff’s RAIs as discussed below.

In RAI 2.3.3.18-1, dated August 7, 2009, the staff requested that the applicant provide clarification for not listing component types for blower and fan housings, casings for compressor and vacuum pump, fire damper housings, drain pans, bolting, washers and nuts, filter housing, screens and strainers, housings for condenser and cooler, fan, heating and cooling coils, pipe fittings, hoses, tubes, rupture disk, and housings for positive pressure devices in LRA Table 2.3.3-18; blower housings, fan housings, vacuum pump casing, drip pans, filter housing, housings for condenser, cooler, fan, heating and cooling coils, pump casing, housings for positive pressure devices, valve bodies, fire damper housings, and damper housings in LRA Table 3.3.2-18; and other component types for wall sealants in above LRA tables.

By letters dated September 3, 2009, and December 14, 2009, the applicant provided an enclosure showing a correlation for component types listed in the tables of LRA Section 2.3. The component types listed in the tables of LRA Section 2.3 were the common component categories that were used in the license renewal database to group the components that are in-scope for license renewal.

Based on the correlation guidelines of the enclosure, the applicant clarified component types as follows:

- Blower and fan housings and casings for compressor and vacuum pumps are not shown as separate line items since they are included in component "type blower" in Table 2.3.3-18 and the equivalent component type "blower, compressor, fan, vacuum pump" in Table 3.3.2-18.
- Fire damper housings are included in the component type "valve body" in the Table 2.3.3-11 and in the line item "valve, damper" in Table 3.3.2-11.
- Component type "drip pans" in Table 2.3.3-18 is equivalent to "drain pans" in Table 3.3.2-18.
- Component type "fasteners" in Table 2.3.3-18 is equivalent to "fastener, bolting, washers, and nuts" in Table 3.3.2-18.
- Component type "filters" in Table 2.3.3-18 is equivalent to "filter, screens, and strainer" in Table 3.3.2-18.
- Component type "heat exchanger" in Table 2.3.3-18 is equivalent to "heat exchanger, condenser, cooler, fan coil" in Table 3.3.2-18. "Condenser and cooler housing" is the only portion of the component in-scope for criterion (a)(2) and the cooling coils for these components are not in-scope of license renewal.
- Component type "heat exchanger" in Table 2.3.3-18 is equivalent to "heat exchanger, condenser, cooler, fan coil and heating coils" in Table 3.3.2-18.
- Component type "piping" in Table 2.3.3-18 is equivalent to "pipe, pipe fittings, hoses, tubes, and rupture disk" in Table 3.3.2-18.
- Component type "pump" in Table 2.3.3-18 is equivalent to "pumps, positive pressure devices (except blowers)" in Table 3.3.2-18.
- Valve bodies and damper housings in Table 3.3.2-18 are not shown as separate line items since they are included in component group "valve, damper."
- Wall sealants are evaluated in the civil/structural area as elastomers in LRA Sections 2.4 and 3.5 of the application.

Based on the above, the applicant concluded that a revision is not necessary for LRA Tables 2.3.3-18 and 3.3.2-18.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.18-1 acceptable because the applicant provided an acceptable correlation such that the component types are properly identified as within the scope of license renewal, and 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). Therefore, the staff's concern described in RAI 2.3.3.18-1 is resolved.

2.3.3.18.3 Conclusion

The staff reviewed the LRA, UFSAR, 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 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 adequately identified the plant ventilation 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).

2.3.3.19 Post-Accident Sampling System

2.3.3.19.1 Summary of Technical Information in the Application

LRA Section 2.3.3.19 describes the post-accident sampling system, which is designed to enable an operator to obtain representative grab samples of reactor coolant, suppression pool liquid, and containment atmosphere for radiological and chemical analyses in association with a postulated LOCA. The system consists of a sample station, sample control panels, a sample piping station, a sample station exhaust fan, a cyclone separator rack, a refrigeration unit, and demineralized water, nitrogen, and tracer gas supplies.

The sample station, sample control panels, refrigeration unit, and demineralized water, nitrogen, and tracer gas supplies are located in the administration building access control area. Isolation valves for liquid and gas sample lines, sample return lines, and the sample station exhaust duct isolation dampers are operated from the control room.

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

The intended functions of the post-accident sampling system component types within the scope of license renewal include:

- maintain pressure-retaining boundary
- maintain primary and secondary containment isolation
- maintenance of nonsafety-related component structural and pressure boundary integrity against adverse physical interaction that could cause safety-related SSC failure

The post-accident sampling system contains safety-related components relied upon to remain functional during and following DBEs. In addition, the system performs functions that support fire protection, ATWS, SBO, and EQ.

2.3.3.19.2 Conclusion

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

2.3.3.20 Primary Containment Heating, Ventilation, and Air Conditioning System

2.3.3.20.1 Summary of Technical Information in the Application

LRA Section 2.3.3.20 describes the primary containment heating, ventilation, and air conditioning system, which maintains ambient temperatures in various areas of the drywell within the ranges dictated by equipment requirements during normal plant operation. The drywell ventilation system is a water-cooled, forced-air system, using well water as the cooling medium. In this system, the temperature of the gas entering and leaving the cooler and the outlet temperature of the well water are monitored. Once steady-state operation is established, variations of these parameters can indicate possible leaks. Since the inlet water has an essentially constant temperature, a rise in outlet temperature indicates additional heat load on the cooling coils and could be indicative of a leak. With the exception of the single fan units, high air or water outlet temperature will actuate an alarm.

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

The intended functions of primary containment heating, ventilation, and air conditioning system component types within the scope of license renewal include:

- maintain primary containment isolation
- maintenance of nonsafety-related component structural and pressure boundary integrity against adverse physical interaction that could cause safety-related SSC failure

The intended function of the primary containment heating, ventilation, and air conditioning system safety-related components is relied upon to remain functional during and following DBEs. In addition, the system performs functions that support ATWS, SBO, and EQ.

2.3.3.20.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.20 and UFSAR Section 5.2.5.2.3.2 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

During its review of LRA Section 2.3.3.20, the staff identified area(s) 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 2.3.3.20-1, dated August 7, 2009, the staff requested that the applicant provide clarification for not listing component types for piping that include pipe Class 1, pipe fittings, and tubing, bolting, washers and nuts, pipe fittings, hoses, tubes, rupture disk, housings for positive pressure devices, fan coil housings, housings for filters, screens, and strainer, fire damper housings, and damper housing in LRA Table 2.3.3-20; casings for pumps and housings for positive devices, housings for filters, screens, strainer, fan coil housings, valve bodies, fire damper housings, and damper housings in LRA Table 3.3.2-20; and other component types for wall sealants in above LRA Tables.

By letter dated September 3, 2009, the applicant provided an enclosure showing a correlation for component types listed in the tables of LRA Section 2.3. The component types listed in the tables of LRA Section 2.3 were the common component categories that were used in the license renewal database to group the components that are within the scope of license renewal.

Based on the correlation guidelines of the enclosure, the applicant clarified component types as follows:

- Component type piping in Table 2.3.3-20 encompasses both "pipe Class 1, pipe fittings, tubing" and "pipe, pipe fittings, hoses, tubes, rupture disk" in Table 3.3.2-20. However, there are no hoses, tubes, or rupture disk contained in primary containment heating, ventilation, and air conditioning system.

- Component type "fasteners" in Table 2.3.3-20 is equivalent to "fastener, bolting, washers, and nuts" in Table 3.3.2-20.

- Pump casings and housings for positive pressure devices are not shown as separate line items since they are included in component group pumps in Table 2.3.3-20 and the equivalent component type "pump and positive pressure devices (except blowers)" in Table 3.3.2-20. There are no housings for positive pressure devices nor positive pressure devices contained in this particular system.

- Fan coil housings are not shown as separate line items since they are included in component type "heat exchanger" in Table 2.3.3-20 and the equivalent component type "heat exchanger, condenser, cooler, and fan coil" in Table 3.3.2-20.

- Housings for filters, screens, and strainers are not shown as separate line items since they are included in the component type "filters" in Table

2.3.3-20 and the equivalent component type “filter, screens, strainer” shown in Table 3.3.2-20.

- Fire damper housings are included in the component type “valve body” in the Table 2.3.3-11 and in the line item “valve, damper” in Table 3.3.2-11.

- Damper housings would not be shown as separate line items since they are included in the component type “valve body” in Table 2.3.3-20 and the equivalent component type “valve, damper” in Table 3.3.2-20.

- The drywell cooling function is not a safety-related function of the primary containment heating, ventilation, and air conditioning system. The ventilation portion of the system is not credited in the CLB as being required to function so the damper housings are not in-scope for 10 CFR 54.4(a)(1). The damper housings are not water filled so they do not meet the requirement for inclusion for 10 CFR 54.4(a)(2). The damper housings are not credited as needed for the regulated events identified in 10 CFR 54.4(a)(3). Therefore, damper housings are not within the scope of license renewal and subject to an AMR in Table 2.3.3-20.

- Wall sealants are evaluated in the civil/structural area as elastomers in Sections 2.4 and 3.5 of the application.

Based on the above, the applicant concluded that a revision is not necessary for LRA Tables 2.3.3-20 and 3.3.2-20.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.20-1 acceptable because the applicant provided an acceptable correlation such that the component types are properly identified as within the scope of license renewal, and 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). Therefore, the staff’s concern described in RAI 2.3.3.20-1 is resolved.

2.3.3.20.3 Conclusion

The staff reviewed the LRA, UFSAR, 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 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 adequately identified the primary containment heating, ventilation, and air conditioning 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).

2.3.3.21 Reactor Building and Radwaste Building Sampling System

2.3.3.21.1 Summary of Technical Information in the Application

LRA Section 2.3.3.21 describes the reactor building and radwaste building sampling system, which provides the ability to obtain samples from various plant equipment located in reactor and radwaste buildings. Samples are used to monitor the operation of plant equipment and provide information for making operational decisions.

Radioactive liquid waste sampling and activity analyses are performed in accordance with technical specifications. Liquid releases are sampled before release; other samples are taken before and after processing. Maximum tank activity and sampling frequency are in accordance with the plant technical specifications.

The radwaste sample station provides the ability to sample collector tanks for gross concentrations to determine the necessary batch process. Sample tanks are sampled for gross activity to determine the effectiveness of the process and to determine if further processing is necessary.

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

The intended function of the reactor building and radwaste building sampling system component type within the scope of license renewal is maintenance of nonsafety-related SSCs that could prevent adverse physical interaction that could cause safety-related SSC failure.

2.3.3.21.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.21, UFSAR Section 9.3.2, and the applicable license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant 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 the requirements of 10 CFR 54.21(a)(1).

The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAI as discussed below.

In RAI 2.3.3.21-01 dated August 7, 2009, the staff noted license renewal drawing BECH-M138<1>-LR (D-7), shows the discharge line from the waste collector pump IP065 to valve V38-0021 as within the scope of license renewal per 10 CFR 54.4(a)(2); however, the ¾-inch line, HBC-30 to sample station SC 3805, attached to the discharge line is not within the scope of license renewal. The applicant was requested to provide additional information explaining why HBC-30 is not within the scope of license renewal per 10 CFR 54.4(a)(2).

In its response dated September 3, 2009, the applicant stated that the portion of the line on the reactor building side of the system boundary is in-scope of license renewal, in accordance with 10 CFR 54.4(a)(2).

Based on its review, the staff finds the applicant's response to RAI 2.3.3.21-01 acceptable because the applicant stated that the portion of the line in the reactor building should have been identified as within the scope of license renewal per 10 CFR 54.4(a)(2). Therefore, the staff's concern described in RAI 2.3.3.21-01 is resolved.

2.3.3.21.3 Conclusion

The staff reviewed the LRA, UFSAR, RAI response, and applicable license renewal drawings 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 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 adequately identified the reactor building and radwaste building sampling system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.22 Reactor Building Closed Cooling Water System

2.3.3.22.1 Summary of Technical Information in the Application

LRA Section 2.3.3.22 describes the reactor building closed cooling water system, which provides required cooling to the equipment located in the reactor building which may contain or have the potential to contain radioactive fluids. The reactor building closed cooling water system is a closed cooling water system using inhibited demineralized water to cool reactor auxiliaries, rejecting heat to general service water. The system contains three heat exchangers and three pumps. Normally, two pumps and two heat exchangers are in-service. An expansion tank is provided to accommodate system volume expansion and contraction

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

The intended functions of the reactor building closed cooling water system component types within the scope of license renewal include:

- maintain primary containment isolation
- maintenance of nonsafety-related component structural and pressure boundary integrity against adverse physical interaction that could cause safety-related SSC failure

2.3.3.22.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.22, UFSAR Section 9.2.5, and the applicable license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAI as discussed below.

In RAI 2.3.3.22-01, dated August 7, 2009, the staff noted license renewal drawing BECH-M147-LR (B-2) shows a continuation of a 10 CFR 54.4(a)(2) pipe section (to CRW) on drawing BECH-M137<1>-LR (B-3). The continuation on drawing M137<1>-LR (B-3) is not included in the scope of license renewal. The applicant was requested to provide additional information to clarify the scoping classification for this pipe section.

In its response dated September 3, 2009, the applicant stated that the continuation arrow on drawing BECH-M147-LR (B-3) should be illustrated as not in-scope for license renewal as the piping represented by this continuation is located in a room that does not contain safety-related equipment. The continuation shown by the arrow is located in a different room containing no safety-related equipment and is not within scope.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.22-01 acceptable because the applicant clarified that the piping section continuation is not within the scope of license renewal. Therefore, the staff's concern described in RAI 2.3.3.22-01 is resolved.

2.3.3.22.3 Conclusion

The staff reviewed the LRA, UFSAR, RAI response, and applicable license renewal drawings 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 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 adequately identified the reactor building closed cooling water system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.23 Reactor Building Heating, Ventilation, and Air Conditioning

2.3.3.23.1 Summary of Technical Information in the Application

RA Section 2.3.3.23 describes the reactor building heating, ventilation, and air conditioning system, which controls the plant air temperatures and the flow of airborne radioactive contaminants to ensure the operability of plant equipment and the accessibility and habitability of plant buildings and compartments. The system controls air temperature to support equipment located in the buildings and allows smoke and heat ventilation in the event of a fire. The reactor building heating, ventilation, and air conditioning system contains safety-related cooling coils for the residual heat removal and core spray rooms, high pressure coolant injection room, and reactor core isolation cooling room. The cooling water for these coils is provided by the emergency service water system.

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

The intended functions of the reactor building heating, ventilation, and air conditioning system component types within the scope of license renewal include:

- provide ventilation in the reactor building
- maintenance of nonsafety-related component structural and pressure boundary integrity against adverse physical interaction that could cause safety-related SSC failure

2.3.3.23.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.23 and UFSAR Section 9.4 using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

During its review of LRA Section 2.3.3.23, the staff identified area(s) 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 2.3.3.23-1 dated August 7, 2009, the staff requested that the applicant provide clarification for not listing component types for accumulator housing, pulsation damper housing, and low pressure tank housing, bolting, washers, and nuts, pipe fittings, hoses, tubes, and rupture disk, housings for positive pressure devices, fire damper housings, fan housings, filter housings, and damper housing in LA Table 2.3.3-23; accumulator housing, pulsation damper housing, and low pressure tank housing, pump casings, housings for positive pressure devices, fan housings, filter housings, fire damper housings, damper housings, and housings for separators and degasifiers in LRA Table 3.3.2-23; and other component types wall sealants in above LRA tables.

By letter dated September 3, 2009, the applicant provided an enclosure showing a correlation for component types listed in the tables of LRA Section 2.3. The component types listed in the tables of LRA Section 2.3 were the common component categories that were used in the license renewal database to group the components that are in-scope for license renewal.

Based on the correlation guidelines of the enclosure, the applicant clarified component types as follows:

- Accumulator housing, pulsation damper housing, and low pressure tank housing are not shown as separate line items since they are included in component group pressure vessel in Table 2.3.3-23 and the equivalent line item "accumulator, pulsation damper, low pressure tank" in Table 3.3.2-23.
- Component type "fasteners" in Table 2.3.3-23 is equivalent to "fasteners, bolting, washers, and nuts" in Table 3.3.2-23.
- Component type "piping" in Table 2.3.3-23 is equivalent to "pipe, pipe fittings, hoses, tubes, and rupture disk" in Table 3.3.2-23.

- Housings for positive pressure devices are included in component type “pump casing” in Table 2.3.3-23 and the equivalent line item “pumps, positive pressure devices (except blowers)” in Table 3.3.2-23.
- Housings for separators and degasifiers are included in the component type “separators” in Table 2.3.3-23 and the equivalent line item “separators, degasifiers” in Table 3.3.2-23.
- Fire damper housings are included in the component type “valve body” in the Table 2.3.3-11 and in the line item “valve, damper” in Table 3.3.2-11.
- There are no fan housings or damper housings within the scope of license renewal and subject to an AMR in the reactor building heating, ventilation, and air conditioning system.
- There are no filter housings within the scope of license renewal and subject to an AMR in the reactor building heating, ventilation, and air conditioning system.
- Wall sealants are evaluated in the civil/structural area as elastomers in Section 2.4 and 3.5 of the application.

Based on the above, the applicant concluded that a revision is not necessary for LRA Tables 2.3.3-23 and 3.3.2-23.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.23-1 acceptable because the applicant provided an acceptable correlation such that the component types are properly identified as within the scope of license renewal, and 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). Therefore, the staff’s concern described in RAI 2.3.3.23-1 is resolved.

2.3.3.23.3 Conclusion

The staff reviewed the LRA, UFSAR, 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 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 adequately identified the reactor building heating, ventilation, and air conditioning 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).

2.3.3.24 Reactor Water Cleanup System

2.3.3.24.1 Summary of Technical Information in the Application

LRA Section 2.3.3.24 describes the reactor water cleanup system, which maintains high reactor water purity to limit chemical and corrosive action, thereby limiting fouling and deposition on heat transfer surfaces. The system removes corrosion products to limit impurities available for activation by neutron flux and resultant radiation from the deposition of corrosion products. Provisions are made for the discharge of reactor water in order to control reactor water level during startup and shutdown, and to limit the heat loss and the fluid loss from the nuclear system.

The reactor water cleanup system consists of two pumps, regenerative and nonregenerative heat exchangers and two filter-demineralizers with supporting equipment. Reactor coolant is removed from the reactor coolant recirculation system, cooled in the regenerative and non-regenerative heat exchangers, filtered and demineralized, and returned to the feedwater system through the shell side of the regenerative heat exchanger.

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

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

- maintaining pressure boundary
- maintain primary containment isolation
- maintenance of nonsafety-related component structural and pressure boundary integrity against adverse physical interaction that could cause safety-related SSC failure

2.3.3.24.2 Conclusion

The staff reviewed the LRA, UFSAR, and drawings 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 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 adequately identified the reactor water cleanup 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).

2.3.3.25 Residual Heat Removal Service Water System

2.3.3.25.1 Summary of Technical Information in the Application

LRA Section 2.3.3.25 describes the RHR service water system, provides a reliable supply of cooling water for heat removal from the RHR system under post-accident conditions and supplies a source of water if post-accident flooding of the core or primary containment is required. RHR service water provides cooling water to the residual heat removal heat exchangers during conditions of normal shutdown and cooldown and for safe shutdown under 10 CFR 50 Appendix R. The system consists of two independent and redundant trains each containing one residual heat removal heat exchanger and two 50 percent residual heat removal service water pumps.

RHR service water uses river water to remove heat from the primary containment under post-accident or ATWS conditions. RHR service water has the capability to return the water either to the cooling towers or directly to the river (if necessary) via circulating water.

The RHR service water system contains safety-related components relied upon to remain functional during and following DBEs. In addition, the RHR service water system performs functions that support fire protection, ATWS, and EQ.

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

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

- providing cooling water for heat removal from the RHR system under post-accident conditions
- providing a source of water if post-accident flooding of the core or primary containment is required
- maintenance of nonsafety-related component structural and pressure boundary integrity against adverse physical interaction that could cause safety-related SSC failure

2.3.3.25.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.25, UFSAR Section 9.2.3, and the applicable license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

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

In RAI 2.3.3.25-01, dated August 7, 2009, the staff noted license renewal drawing BECH-M119-LR (B-3 and B-4) and drawing BECH-M120-LR (B-6) show the 12-inch-GBB-6, 12-inch-GBB-8, 12-inch-GBB-7, and 12-inch-GBB-9 lines as within scope for license renewal for 10 CFR 54.4(a)(1) whereas the continuations of these same lines on license renewal drawing BECH-M113-LR (E-6 and E-7), are shown as not within the scope of license renewal. The applicant was requested to provide additional information explaining why there is a difference in scope classification between drawings BECH-M119-LR, BECH-M120-LR and the continuations on BECH-M113-LR.

In its response dated September 3, 2009, the applicant stated the lines are in-scope for 10 CFR 54.4(a)(1) and should have been colored red to indicate this scoping classification.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.25-01 acceptable because the applicant stated the lines are in-scope for 10 CFR 54.4(a)(1). Therefore, the staff's concern described in RAI 2.3.3.25-01 is resolved.

In RAI 2.3.3.25-02, dated August 7, 2009, the staff noted license renewal drawing BECH-M119-LR (B-5 and B-6), shows a change of scope classification from 10 CFR 54.4(a)(1) to 10 CFR 54.4(a)(2) at valves V13-0074 and V13-0076 whereas the corresponding seismic Class I break is shown at valves V13-0073 and V13-0075, respectively. The applicant was requested to provide additional information to explain why seismic Class I pipe is within scope for 10 CFR 54.4(a)(2) versus 10 CFR 54.4(a)(1).

In its response dated September 3, 2009, the applicant stated V13-0073 and V13-0075 are nonsafety-related outboard drain valves located downstream of normally closed safety-related valves V13-0074 and V13-0076. These outboard drain valves are shown with seismic breaks because they are included in the seismic analysis. The seismic analysis is carried out to the second isolation valve. The piping downstream of V13-007 4 and V13-0076 is not safety-related.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.25-02 acceptable because the applicant clarified the scoping classification of the piping near valves V13-0074 and V13-0076. Therefore, the staff's concern described in RAI 2.3.3.25-02 is resolved.

In RAI 2.3.3.25-03, dated August 7, 2009, the staff noted license renewal drawing BECH-M119-LR (C-5 and C-6) shows lines 16-inch-GBC-3 and 16-inch-GBC-4 as within scope for 10 CFR 54.4(a)(1). Two thermal elements TE1945F and TE1945B are connected to 16-inch-GBC-3 and 16-inch-GBC-4 and the connecting lines are shown as not within the scope of license renewal. The applicant was requested to provide additional information to explain why the lines to the thermal elements are not within scope.

In its response dated September 3, 2009, the applicant stated that the two thermal elements connected to the 16-inch lines are installed in thermowells and the subject lines do not represent piping.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.25-03 acceptable because the applicant clarified that the thermal elements are installed in thermowells. Therefore, the staff's concern described in RAI 2.3.3.25-03 is resolved.

2.3.3.25.3 Conclusion

The staff reviewed the LRA, RAI responses, and applicable license renewal drawings 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 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 adequately identified the RHR service water system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.26 River Water Supply System

2.3.3.26.1 Summary of Technical Information in the Application

LRA Section 2.3.3.26 describes the river water supply system, which consists of four river water pumps located in two separate wet pits in the intake structure. The wet pits are supplied from the Cedar River through two channels that contain bar racks and traveling screens to prevent debris from entering the pits. The four river water pumps deliver water through two lines to a stilling basin. The basin supplies the RHR service water and emergency service water wet-pit sumps to maintain a safe operating level. An overflow weir in the stilling basis makes the excess flow available to circulating water, fire protection system, and general service water.

The failure of nonsafety-related SSCs in the river water supply system potentially could prevent the satisfactory accomplishment of a safety-related function. In addition, the river water supply system performs functions that support fire protection.

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

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

- providing sufficient river water to meet all emergency plant requirements for cooling, including RHR service water and emergency service water system

- maintenance of nonsafety-related component structural and pressure boundary integrity against adverse physical interaction that could cause safety-related SSC failure

2.3.3.26.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.26, UFSAR Section 9.2.2, and the applicable license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant 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 the requirements of 10 CFR 54.21(a)(1).

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 2.3.3.26-01, dated August 7, 2009, the staff noted LRA drawing BECH-M146-LR (E-6), upstream of valves V46-0045 and V46-0046 depicts two functional seismic class I breaks that are located on the 10 CFR 54.4(a)(2) portion of the air vents. The applicant was requested to provide additional information to explain not including the portions of the air vent and piping downstream of the functional seismic class I break as within scope for 10 CFR 54.4(a)(1).

In its response dated September 3, 2009, the applicant stated, "AV4916 and AV4917 are nonsafety-related vents located downstream of normally closed safety-related valves V46-0045 and V46-0046…," which are included in the seismic analysis.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.26-01 acceptable because the applicant stated the air vents are nonsafety-related, but are included in the seismic analysis. Therefore, the staff's concern described in RAI 2.3.3.26-01 is resolved.

In RAI 2.3.3.26-02, dated August 7, 2009, the staff noted LRA drawing BECH-M146-LR (F-4) upstream of valve V46-0086, shows a portion of 10 CFR 54.4(a)(2) piping continued from the floor drain radwaste system that connects to 10 CFR 54.4(a)(1) piping. License renewal note 2 indicates that only 2-inch-HBD-79 is within scope for that portion within the pump house. The applicant was requested to provide confirmation that an equivalent anchor exists at the pump house boundary or provide the location of the equivalent anchor.

In its response dated September 3, 2009, the applicant stated, "An anchor is present on line 2-inch-HBD-79 just after the line enters the pump house from below grade."

Based on its review, the staff finds the applicant's response to RAI 2.3.3.26-02 acceptable because the applicant stated an anchor exists after the line enters the pump house. Therefore, the staff's concern described in RAI 2.3.3.26-02 is resolved.

2.3.3.26.3 Conclusion

The staff reviewed the LRA, UFSAR, RAI responses, and applicable license renewal drawings 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 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 adequately identified the river water supply 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).

2.3.3.27 Safety-Related Air System

2.3.3.27.1 Summary of Technical Information in the Application

LRA Section 2.3.3.27 describes the safety-related air system as designed to provide compressed air to support certain systems and components that function to limit fission to limit fission product release and control the environment from which the unit can be operated following a design basis accident. The safety-related air system consists of two independent and redundant subsystems. Each of the two subsystems is made up of a compressor, air receiver, associated instrumentation, and piping.

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

The intended function of the safety-related air system component types within the scope of license renewal is to provide compressed air to support systems and components that function to limit fission product release and control the environment from which the unit can be safely operated following a DBA.

2.3.3.27.2 Conclusion

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

2.3.3.28 Solid Radwaste

2.3.3.28.1 Summary of Technical Information in the Application

LRA Section 2.3.3.28 describes the solid radwaste system, the solid radwaste areas that are located in the radwaste building, the low level radwaste processing and storage facility, and the off-gas retention building. The wet solid wastes are spent demineralizer resins and filter sludge. The dry solid radwaste consists of miscellaneous radioactive and contaminated solid wastes.

The liquid radwaste system collects, monitors, processes, stores, and disposes of radioactive liquid wastes. The liquid radwaste is classified, collected, and treated as high purity, low purity, chemical detergent, sludge, or spent resins. The liquid radwaste system provides for filtration and demineralization of both waste collector (high purity) and floor drain (low purity) effluents.

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

The intended function of the sampling system component type within the scope of license renewal is maintenance of nonsafety-related component structural and pressure boundary integrity against adverse physical interaction that could cause safety-related SSC failure.

2.3.3.28.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.28, UFSAR Sections 11.2 and 11.4, and the applicable license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

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 2.3.3.28-01, dated August 7, 2009, the staff noted license renewal drawing BECH-M182-LR (A-5) shows continuation of 1½-inch-HBD-60 downstream of valves V82-0113 and V82-0111 as within the scope of license renewal per 10 CFR 54.4(a)(2). The continuation of the line on license renewal drawing BECH-M160<1> (F-2) is shown as not in-scope for license renewal. The applicant was requested to provide additional information for the continuation of the line downstream of valves V82-0113 and V82-0111 to clarify the location of the license renewal boundary.

In its response dated September 3, 2009, the applicant stated, “The system boundary on drawing BECH-M160<1>-LR (F-2) should have been placed at the underground transition marker…” and the above ground sections of these lines should have been shown as within the scope of license renewal per 10 CFR 54.4(a)(2). In addition, the continuation for 1½-inch line HBD-60 upstream of valves V82-0113 and V82-0111 on license renewal drawing BECH-M182-LR (A-5) should have been identified as within the scope of license renewal per 10 CFR 54.4(a)(2). The above ground portions of 1½-inch line HBD-60 located in the turbine building are also within the scope of license renewal per 10 CFR 54.4(a)(2).

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.28-01 acceptable because the applicant identified the appropriate license renewal boundaries and clarified which portions of 1½-inch-HBD-60 are within the scope of license renewal. Therefore, the staff’s concern described in RAI 2.3.3.28-01 is resolved.

In RAI 2.3.3.28-02, dated August 7, 2009, the staff noted license renewal drawing BECH-M139-LR (C-3), shows ½-inch line HCD-54 as within the scope of license renewal per 10 CFR 54.4(a)(2). The license renewal boundary is shown at valve V39-0053 and the continuation of the line is shown as not in-scope for license renewal. The applicant was requested to provide additional information for the continuation of ½-inch line HCD-54 to clarify the location of the license renewal boundary.

In its response dated September 3, 2009, the applicant stated that the ½-inch line HCD-54 on license renewal drawing BECH-M139-LR (C-3) was incorrectly identified as being within the scope of license renewal per 10 CFR 54.4(a)(2). This line is in the radwaste building in areas that do not contain safety-related equipment.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.28-02 acceptable because the applicant identified the appropriate license renewal boundaries and clarified that ½-inch line HCD-54 is not within the scope of license renewal. Therefore, the staff’s concern described in RAI 2.3.3.28-02 is resolved.

In RAI 2.3.3.28-03, dated August 7, 2009, the staff noted license renewal drawing BECH-M139-LR (C-2), shows 1½-inch-HCD-36 as within the scope of license renewal per 10 CFR 54.4(a)(2). The license renewal boundary is shown at valve V39-0075 and the continuation of the line is shown as not in-scope for license renewal. The applicant was requested to provide additional information as to the continuation of 1½-inch-HCD-36 to clarify the location of the license renewal boundary.

In its response dated September 3, 2009, the applicant stated that the continuation of 1½-inch line HCD-36 on license renewal drawing BECH-M139-LR (C-2) was incorrectly identified as within the scope of license renewal per 10 CFR 54.4(a)(2). Line HCD-36 is located in areas of the radwaste building that do not contain safety-related equipment.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.28-03 acceptable because the applicant identified the appropriate license renewal boundaries and clarified which portions of 1½-inch line HCD-36 are within the scope of license renewal per 10 CFR 54.4(a)(2). Therefore, the staff’s concern described in RAI 2.3.3.28-03 is resolved.

2.3.3.28.3 Conclusion

The staff reviewed the LRA, UFSAR, RAI responses and drawings 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 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 adequately identified the solid waste system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.29 Standby Diesel Generators

2.3.3.29.1 Summary of Technical Information in the Application

LRA Section 2.3.3.29 describes the standby diesel generators system, which is composed of two electrically and physically separated diesel generator subsystems, each capable of independently supplying emergency power to its associated 4,160-volt bus.

The two auxiliary buses supplying power to the auxiliaries and engineered safety features required for safe shutdown are designated essential buses. Each essential bus is capable of receiving power from reliable offsite sources through either the startup or standby transformers and from one of two standby diesel generators. The standby diesel generators are physically and electrically separated from the offsite power source. The standby diesel generators are the emergency sources of auxiliary AC power. These generators start automatically on LOCA and loss of AC power signals. Each diesel generator has the capacity to operate all systems required to achieve and maintain safe shutdown or mitigate an ATWS event.

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

The intended functions of standby diesel generators system component types within the scope of license renewal include:

- supply 4.16-kilovolt (kV) power to essential 4.16-kV buses
- provide sufficient fuel storage capacity to safely shutdown the plant after a design-basis accident coincident with a loss of offsite power
- maintenance of nonsafety-related component structural and pressure boundary integrity against adverse physical interaction that could cause safety-related SSC failure

The intended function of the standby diesel generators system safety-related components relied upon to remain functional during and following DBEs. In addition, the system performs functions that support ATWS, SBO, and fire protection.

2.3.3.29.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.29, UFSAR Sections 8.3.1 and 9.5.4, and the applicable license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

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 2.3.3.29-01, dated August 7, 2009, the staff noted license renewal drawing BECH-M132<1>-LR shows the following components within scope for license renewal based on 10 CFR 54.4(a)(1) or (a)(2) and are not included in the list of AMR components in LRA Table 2.3.3-29:

- exhaust silencers at locations C-7 and E-7
- vent and flame arrestors at locations C-4, E-4, and A-3
- combustion air filter-silencer at locations B-5 and E-5

The applicant was requested to provide additional information explaining why exhaust silencers, vent and flame arrestors, and combustion air filter-silencers are not included as component types in LRA Table 2.3.3-29.

In its response dated September 3, 2009, the applicant stated that the subject components are all in-scope and subject to an AMR. The exhaust silencers and vent and flame arrestors are included in the component type "piping" in LRA Table 2.3.3-29. The combustion air filter-silencers are included in the component type "filter" in LRA Table 2.3.3-29.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.29-01 acceptable because the applicant stated that the exhaust silencers, vent and flame arrestors, and combustion air filter-silencer are in-scope and subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.29-01 is resolved.

In RAI 2.3.3.29-02, dated August 7, 2009, the staff noted license renewal drawing BECH-M132<1>-LR (C-6 and E-6) shows a black boundary for the standby diesel generators in lieu of red. License renewal drawing legend note for 10 CFR 54.4(a)(1) or (a)(3) components states, "Components in scope per 10 CFR 54.4(a)(1) and/or (a)(3) and subject to an AMR per [10 CFR] 54.21." The drawing does not provide indication that the diesel generators are in-scope for 10 CFR 54.4(a)(1). The applicant was requested to provide additional information to confirm that the standby diesel generators are in-scope for 10 CFR 54.4(a)(1).

In its response dated September 3, 2009, the applicant stated, "The standby diesel generators are in-scope for license renewal but screen out as active per 10 CFR 54.21 and NEI 95-02, Appendix B. Therefore they are not subject to aging management review and are appropriately colored black."

Based on its review, the staff finds the applicant's response to RAI 2.3.3.29-02 acceptable because the applicant stated that the standby diesel generators are in-scope, but not subject to an AMR and colored black because they are considered an active component. Therefore, the staff's concern described in RAI 2.3.3.29-02 is resolved.

In RAI 2.3.3.29-03, dated August 7, 2009, the staff noted that typically the fuel injector housing and the turbo-charger housings are identified in license renewal drawings and included in the table listing component types subject to an AMR. The staff finds no reference to either the fuel injector housing or the turbo-charger housing in either the license renewal drawings or the table listing component types subject to an AMR. The applicant was requested to provide additional information explaining why the fuel injector and turbocharger housings are not included in either the license renewal drawings or the table listing component types subject to an AMR.

In its response dated September 3, 2009, the applicant stated that the subject components are considered part of the active diesel engines and per 10 CFR 54.21 and NEI 95-10 Appendix B, are not subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.29-03 acceptable because the applicant stated the fuel injector housings and turbo-charger housings are parts within an active diesel engine. Therefore, the staff's concern described in RAI 2.3.3.29-03 is resolved.

2.3.3.29.3 Conclusion

The staff reviewed the LRA, UFSAR, RAI responses, and applicable license renewal drawings 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 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 adequately identified the standby diesel generator system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.3.30 Standby Liquid Control System

2.3.3.30.1 Summary of Technical Information in the Application

LRA Section 2.3.3.30 describes the standby liquid control system, which provides a backup method, independent of control rods, to bring and maintain the reactor subcritical as the nuclear system cools. This is accomplished by pumping a neutron-absorbing solution (sodium pentaborate) into the reactor in sufficient quantity and concentration to overcome the maximum positive reactivity resulting from cooldown and xenon decay after a complete shutdown and to provide the required shutdown margin. The system is designed to bring the reactor from rated power to a cold shutdown at anytime in core life.

Standby liquid control is manually initiated from the main control room to pump a boron neutron-absorber (sodium pentaborate) solution into the reactor if the operator believes the reactor cannot be shut down or kept shut down with the control rods. Standby liquid control consists of a boron solution tank, a test water tank, two positive-displacement pumps, two explosive valves, and associated local valves and controls mounted in the reactor building outside primary containment. The liquid is piped into the reactor vessel and discharged near the bottom of the core shroud so that it mixes with the cooling water rising through the core.

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

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

The intended functions of standby liquid control system component types within the scope of license renewal include:

- provide borated water to the reactor coolant system to bring the reactor to a shutdown condition at any time in the reactor core life
- provide containment isolation
- maintain reactor coolant pressure boundary
- maintenance of nonsafety-related component structural and pressure boundary integrity against adverse physical interaction that could cause safety-related SSC failure

The intended function of the standby liquid control system safety-related components relied upon to remain functional during and following DBEs. In addition, the system performs functions that support ATWS and fire protection.

2.3.3.30.2 Conclusion

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

2.3.3.31 Turbine Building Sampling System

2.3.3.31.1 Summary of Technical Information in the Application

LRA Section 2.3.3.31 describes the turbine building sampling system, which is designed to obtain representative samples in forms that can be used in radiochemical laboratory analysis. The process sampling systems allow monitoring of plant equipment operation and provide information for making operational decisions with regard to effectiveness and proper performance. Turbine building sampling system includes sampling for main steam, condensate pumps, steam packing exhauster, feedwater heaters, condensate lines to and from the demineralizers, and the condensate demineralizer tanks.

The failure of nonsafety-related SSCs in the turbine building sampling system potentially could prevent the satisfactory accomplishment of a safety-related function.

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

The intended function of the turbine building sampling system component type within the scope of license renewal is maintenance of nonsafety-related component structural and pressure boundary integrity against adverse physical interaction that could cause safety-related SSC failure.

2.3.3.31.2 Conclusion

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

2.3.3.32 Well Water System

2.3.3.32.1 Summary of Technical Information in the Application

LRA Section 2.3.3.32 describes the well water system, which removes heat from components during startup, normal operation, shutdown, and cooldown. Well water provides cooling water for all the plant ventilation cooling units, supplies potable water, and supplies water for demineralizer makeup. Well water has a normally closed crosstie that can provide a backup supply of water to fire protection during conditions where the circulating pit is drained. The system consists of four independent wells. The wells are sealed to prevent the collection of less desirable ground water from shallower aquifers. The system provides water for drinking and sanitary purposes. The water is filtered and purified as necessary to meet applicable drinking water standards.

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

The intended function of the well water system component type within the scope of license renewal is maintenance of nonsafety-related components' adverse physical interaction that could cause safety-related SSC failure.

2.3.3.32.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.32, UFSAR Section 9.2.1, and the license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant 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 the requirements of 10 CFR 54.21(a)(1).

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 2.3.3.32-01, dated August 7, 2009, the staff noted license renewal drawing BECH-M142-LR (B-3) shows a 2-inch-JBD-59 pipe line as not within the scope of license renewal. However, the continuation of this 2-inch line to M146 (E-3) is within the scope of license renewal for 10 CFR 54.4(a)(2). Also the continuation from BECH M-144<01> (D-2) is within the scope for 10 CFR 54.4(a)(2). The applicant was requested to provide additional information to clarify why this pipe section is not within scope.

In its response dated September 3, 2009, the applicant stated the 2-inch-JBD-59 pipe section and valves V42-009S and V42-0100 on BECH-M142-LR should be colored green and are within scope and subject to an AMR for 10 CFR 54.4(a)(2).

Based on its review, the staff finds the applicant's response to RAI 2.3.3.32-01 acceptable because the applicant stated that this pipe section and valves are within scope for 10 CFR 54.4(a)(2) and subject to an AMR. Therefore, the staff's concern described in RAI 2.3.3.32-01 is resolved.

In RAI 2.3.3.32-02, dated August 7, 2009, the staff noted license renewal drawing BECH-M113-LR (A-8) shows a 10 CFR 54.4(a)(2) line (8-inch-JBD-34) connected to a 10 CFR 54.4(a)(1) line (8-inch-HBD-32) at valve V13-0014. The location of the anchor for the nonsafety-related SSCs directly connected to safety-related SSCs could not be located. The applicant was requested to provide additional information to locate the anchor.

In its response dated September 3, 2009, the applicant provided the location of the anchor and identified additional equivalent seismic anchors. The applicant also identified an additional component that should have been identified as in-scope for license renewal and subject to an AMR. Revisions to LRA Tables 2.3.3-17 and 3.3.2-17 were provided to account for the additional components.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.32-02 acceptable because the applicant provided sufficient information to locate the seismic anchors and revised the LRA to reflect the additional component type now within scope. Therefore, the staff's concern described in RAI 2.3.3.32-02 is resolved.

In RAI 2.3.3.32-03, dated August 7, 2009, the staff noted license renewal drawing BECH-M144<1>LR (F-8) shows a continuation from M-144<2> (D-4) as not in-scope for 10 CFR 54.4(a)(2). However, the continuation of this line from a dot-dash-dot line is within scope for 10 CFR 54.4(a)(2). The applicant was requested to provide additional information to clarify the license renewal boundary.

In its response dated September 3, 2009, the applicant stated the dot-dash-dot line represents the exterior wall of the reactor building and the piping outside of the reactor building is not in-scope for license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.3.3.32-03 acceptable because the applicant clarified that the well water piping outside the reactor building is not in-scope for license renewal. Therefore, the staff's concern described in RAI 2.3.3.32-03 is resolved.

In RAI 2.3.3.32-04, dated August 7, 2009, the staff noted license renewal drawing BECH-M144<1>-LR (A-3) shows: a pipe section 3-inch-JDD-3 enclosed within braces ([ ]) as within scope for license renewal for 10 CFR 54.4(a)(2); the connected line to valve V44-0487 as not in-scope, and the continuation to "To Radwaste Lavatory Facilities" was not provided. The applicant was requested to provide additional information to: clarify the significance of the braces ([ ]) for locating a license renewal boundary; clarify why the connected line to valve V44-0487 is not in-scope and to locate the continuation to “To Radwaste Lavatory Facilities.”

In its response dated September 3, 2009, the applicant stated:

- The braces, green color of the pipe, and the green “RB” delineate that portion of the domestic water system which is in the reactor building. This portion of the system is in-scope for license renewal, in accordance with 10 CFR 54.4(a)(2), and subject to an AMR.

- V44-0487 is in a short section of domestic water pipe contained in the north reactor building stairwell, which is an enclosed space with no safety-related components. This portion of the system is not in-scope for license renewal.

- No drawing could be located which shows a continuation to lavatory facilities. This pipe leaves the reactor building and enters the radwaste building heating and ventilation (H&V) room. An isolation damper classified as safety-related is located in this room. Thus, this pipe is within scope for license renewal for 10 CFR 54.4(a)(2).

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.32-04 acceptable because the applicant clarified the significance of the braces, why V44-0487 is not within scope, and provided a description of the license renewal boundary. Therefore, the staff’s concern described in RAI 2.3.3.32-04 is resolved.

In RAI 2.3.3.32-05, dated August 7, 2009, the staff noted license renewal drawing BECH-M144<1>-LR (E-7)) shows 1½-inch-JBD-29 from the evaporator room cooling unit as not within scope for 10 CFR 54.4(a)(2). However the connected 1½-inch-JBD-29 pipe section is within scope for 10 CFR 54.4(a)(2). The applicant was requested to provide additional information to clarify the scoping classification for this section of pipe.

In its response dated September 3, 2009, the applicant stated that the piping within scope for license renewal and subject to an AMR for 10 CFR 54.4(a)(2) is located in the radwaste building HVAC room. Line 1½-inch-JBD-29 on the return from 1VAC042 is outside the radwaste building HVAC room, is not in-scope, and is appropriately colored black.

Based on its review, the staff finds the applicant’s response to RAI 2.3.3.32-05 acceptable because the applicant clarified that the pipe section is outside the radwaste building HVAC room and is not within the scope of license renewal. Therefore, the staff’s concern described in RAI 2.3.3.32-05 is resolved.

2.3.3.32.3 Conclusion

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

2.3.3.33 Zinc Injection System

2.3.3.33.1 Summary of Technical Information in the Application

LRA Section 2.3.3.33 describes the zinc injection system, which consists of a zinc addition skid that injects trace amounts of depleted zinc oxide (DZO) into the feedwater during normal plant operation. Maintaining trace quantities of ionic zinc in the reactor water reduces radiation levels by maintaining/reducing cobalt 60 buildup on primary system surfaces.

The system consists of a recirculation loop off of the feedwater system. A stream of feedwater from the feed pump discharge header is passed through the dissolution vessel containing depleted zinc oxide pellets, dissolving the pellets, and returned to the feed pump suction header.

LRA Table 2.3.3-33 identifies the component types within the scope of license renewal and subject to an AMR.

The intended function of the zinc injection system component type within the scope of license renewal is maintenance of nonsafety-related component structural and pressure boundary integrity against adverse physical interaction that could cause safety-related SSC failure.

2.3.3.33.2 Conclusion

Based on the results of the staff evaluation discussed in Section 2.3 and on a review of the LRA, UFSAR, and applicable license renewal drawings, the staff concludes that the applicant has appropriately identified the zinc injection 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 zinc injection system components subject to an AMR, in accordance with the requirements stated in 10 CFR 54.21(a)(1).

2.3.4 Steam and Power Conversion Systems

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

- 2.3.4.1 condensate and demineralized water system
- 2.3.4.2 condensate and feedwater system
- 2.3.4.3 condenser and condenser air removal system
- 2.3.4.4 main steam isolation and automatic depressurization system
- 2.3.4.5 turbine

2.3.4.1 Condensate and Demineralized Water System

2.3.4.1.1 Summary of Technical Information in the Application

LRA Section 2.3.4.1 describes the condensate and demineralized water system, which includes the condensate storage and transfer system, condensate demineralizer system, and the makeup water treatment system.

The condensate storage and transfer system stores the condensate required for the operation and servicing of the nuclear power plant and transfers this condensate for various uses. The system includes two 200,000-gallon condensate storage tanks which provide sufficient capacity for refueling, normal service, and emergency demand and two 100 percent capacity pumps and one jockey pump.

The condensate demineralizer system ensures that water of the required purity is supplied to the reactor. The condensate demineralizer system consists of five filter demineralizer vessels and the associated piping, instrumentation, and controls to facilitate continuous processing of the design condensate flow.

The makeup water treatment system processes and stores demineralized water for use in the plant. The system is supplied from the well water system and processes the well water using portable demineralizers. The demineralized water is stored in a 50,000-gallon lined carbon steel tank. Two transfer pumps are used to supply plant requirements for demineralized water or to supply makeup to the condensate storage tank.

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

The intended functions of the condensate and demineralized water system component types within the scope of license renewal include:

- maintain primary containment integrity
- maintenance of nonsafety-related component structural and pressure boundary integrity against adverse physical interaction that could cause safety-related SSC failure

The intended function of the condensate and demineralized water system safety-related components relied upon to remain functional during and following DBEs. In addition, the system performs functions that support SBO and fire protection.

2.3.4.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.1, UFSAR Section 9.3.6, and the license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

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 2.3.4.1-01, dated August 7, 2009, the staff noted license renewal drawing BECH-M106-LR (F-6) does not show lines connecting with instruments PI1475 and PP1472. The applicant was requested to provide additional information to establish the scope classification for these lines.

In its response dated September 3, 2009, the applicant stated, "…the drawing should show green lines connecting PI1475 and PP1472 to the ¾" [inch] instrument line."

Based on its review, the staff finds the applicant's response to RAI 2.3.4.1-01 acceptable because the applicant clarified that the line in question was within scope. Therefore, the staff's concern described in RAI 2.3.4.1-01 is resolved.

In RAI 2.3.4.1-02, dated August 7, 2009, the staff noted license renewal drawing BECH-M106-LR (E-6) shows an instrumentation line between instruments CIT 1516A and CRS 1415 as not within scope, within scope for 10 CFR 54.4(a)(2), and then, not within scope. The applicant was requested to provide additional information to establish the scope classification for this line.

In its response dated September 3, 2009, the applicant stated, "CIT 1516A is a conductivity indicating transmitter and the dashed line to CRS 1514 (conductivity recording switch) is a depiction of an electrical connection between them, not piping. Some of the dashes between the instruments were inadvertently colored green and should have been black."

Based on its review, the staff finds the applicant's response to RAI 2.3.4.1-02 acceptable because the applicant clarified the line in question was not within scope. Therefore, the staff's concern described in RAI 2.3.4.1-02 is resolved.

In RAI 2.3.4.1-03, dated August 7, 2009, the staff noted license renewal drawing BECH-M109-LR (D-1 and F-7) shows lines in and out of the demineralized water storage tank heaters 1E014 and 1E015 as within scope for license renewal for 10 CFR 54.4(a)(2). However, the continuation of these lines on drawing BECH-M163-LR (E-2) shows these lines not within scope for 10 CFR 54.4(a)(2). The applicant was requested to provide additional information explaining why there is a difference in scope classification between drawing BECH-M109-LR and the continuation on BECH-M163-LR.

In its response dated September 3, 2009, the applicant stated, "…the auxiliary heating system lines are in scope and subject to aging management review for 10 CFR54.4(a)(2), and should be colored green."

Based on its review, the staff finds the applicant's response to RAI 2.3.4.1-03 acceptable because the applicant clarified the lines in question are within scope. Therefore, the staff's concern described in RAI 2.3.4.1-03 is resolved.

In RAI 2.3.4.1-04, dated August 7, 2009, the staff noted license renewal drawing BECH-M109-LR (D-4) shows the line downstream of valve V09-0206 as within scope for license renewal for 10 CFR 54.4(a)(2). However, the continuation of this line on drawing BECH-M131-LR (C-4) shows this line not within scope for 10 CFR 54.4(a)(2). The applicant was requested to provide additional information explaining why there is a difference in scope classification between drawing BECH-M109-LR and the continuation on BECH-M131-LR.

In its response dated September 3, 2009, the applicant stated in part, “On drawing BECH-M109-LR (D-4) the line downstream of closed valve V09-0206 is not in scope due to being isolated and abandoned in place (i.e., cut and capped).”

Based on its review, the staff finds the applicant’s response to RAI 2.3.4.1-04 acceptable because the applicant clarified that the line in question is abandoned in place. Therefore, the staff’s concern described in RAI 2.3.4.1-04 is resolved.

In RAI 2.3.4.1-05, dated August 7, 2009, the staff noted license renewal drawing BECH-M110-LR (B-2) shows the line downstream of valve V10-0098 as within scope for license renewal for 10 CFR 54.4(a)(2). However, the continuation of this line on drawing BECH-M137<1>-LR (F-5) shows this line as not within scope for 10 CFR 54.4(a)(2). The applicant was requested to provide additional information explaining why there is a difference in scope classification between drawing BECH-M110-LR and the continuation on BECH-M137<1>-LR.

In its response dated September 3, 2009, the applicant stated the continuation line to the turbine building floor drain sump from BECH-M110, TB Aux Sump 1P100A and B, is in-scope for 10 CFR 54.4(a)(2). The continuation line depiction on BECH-M137<1>-LR from BECH-M110 is located in the turbine building floor drain sump room that contains no safety-related equipment. Therefore, the piping is not in-scope for 10 CFR 54.4(a)(2).

Based on its review, the staff finds the applicant’s response to RAI 2.3.4.1-05 acceptable because the applicant clarified that the line in question was not within scope. Therefore, the staff’s concern described in RAI 2.3.4.1-05 is resolved.

In RAI 2.3.4.1-06, dated August 7, 2009, the staff noted license renewal drawing BECH-M110-LR (C-3) shows line ½-inch-HBD-142 upstream of the neutralizing tank 1T022 as within scope for 10 CFR 54.4(a)(2), not within scope, and then within scope for 10 CFR 54.4(a)(2). The applicant was requested to provide additional information to establish the scope classification for this line.

In its response dated September 3, 2009, the applicant stated in part, “…the black portion of the line ½” [inch]-HBD-142 is within scope and subject to aging management review for 10 CFR 54.4(a)(2), and should be colored green.”

Based on its review, the staff finds the applicant’s response to RAI 2.3.4.1-06 acceptable because the applicant clarified that the line in question was within scope. Therefore, the staff’s concern described in RAI 2.3.4.1-06 is resolved.

In RAI 2.3.4.1-07, dated August 7, 2009, the staff noted license renewal drawing BECH-M110-LR shows equipment as abandoned in place, however significant piping is identified as within scope for 10 CFR 54.4(a)(2). The applicant was requested to provide additional information to clarify the mixing of within scope versus abandoned in place on license renewal drawing BECH-M110-LR.

In its response dated September 3, 2009, the applicant stated in part, “…the make-up demineralizer has been abandoned. However, the demineralizer piping is not cut and capped, and lines are pressurized to the first isolation valve. Therefore the piping is in scope for 10 CFR 54.4(a)(2) and subject to aging management review."

Based on its review, the staff finds the applicant's response to RAI 2.3.4.1-07 acceptable because the applicant clarified the "within scope" versus "abandoned in place" piping. Therefore, the staff's concern described in RAI 2.3.4.1-07 is resolved.

In RAI 2.3.4.1-08, dated August 7, 2009, the staff noted license renewal drawing BECH-M136-LR (F-1) shows line 1½-inch-HCD-36 downstream of valve V36-0045 as not within scope for license renewal. The continuation of this line on drawing BECH-M139-LR (D-2) shows this line as within scope for 10 CFR 54.4(a)(2). The applicant was requested to provide additional information explaining why there is a difference in scope classification between drawing BECH-M136-LR and the continuation on BECH-M139-LR.

In its response dated September 3, 2009, the applicant stated in part, "…line 1½-inch-HCD-36 is not within scope because it is located in the radwaste building and not in an area containing safety-related equipment."

Based on its review, the staff finds the applicant's response to RAI 2.3.4.1-08 acceptable because the applicant clarified the line in question was not within scope. Therefore, the staff's concern described in RAI 2.3.4.1-08 is resolved.

In RAI 2.3.4.1-09, dated August 7, 2009, the staff noted license renewal drawing BECH-M189<1>-LR (A-7) shows two ½-inch lines, HCD-182, and the associated check valves V89-0072 and V89-0074 within the scope of license renewal per 10 CFR 54.4(a)(2). The license renewal boundary is shown to be at the check valve. The continuations of the lines HCD-182, upstream of the check valves, are shown as not within the scope of license renewal. The applicant was requested to provide additional information explaining why the ½-inch lines HCD-182 continuations upstream of the check valves V89-0072 and V89-0074 are not within the scope of license renewal.

In its response dated September 3, 2009, the applicant stated:

> …the lines downstream of check valves V89-0072 and V89-0074 are feedwater system pressure boundary components; they are within scope of license renewal and subject to AMR due to 10 CFR 54.4(a)(2). The lines upstream of check valves V89-0072 and V89-0074 contain gas (O_2) and are not in scope since they do not have a license renewal intended function.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.1-09 acceptable because the applicant clarified the lines in question are gas lines and not within scope. Therefore, the staff's concern described in RAI 2.3.4.1-09 is resolved.

2.3.4.1.3 Conclusion

The staff reviewed the LRA, UFSAR, RAI responses, and applicable license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant adequately identified the condensate and demineralized water system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.2 Condensate and Feedwater System

2.3.4.2.1 Summary of Technical Information in the Application

LRA Section 2.3.4.2 describes the condensate and feedwater system, which includes the feedwater control system and the extraction steam, heaters, vents, and drains system. The condensate and feedwater system provide a dependable supply of feedwater to the reactor, provides feedwater heating, and minimizes water-quality problems.

Two motor-driven centrifugal condensate pumps deliver water through the steam packing exhaust condenser, air ejector, condensate demineralizer, and low pressure feedwater heaters to the suction of the reactor feedwater pumps, with sufficicient pressure to satisfy suction head requirements of the feed pumps. Two motor-driven centrifugal feedwater pumps deliver water through the high pressure heaters and the feedwater control valves to the reactor.

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

The intended functions of the condensate and feedwater system component types within the scope of license renewal include:

- maintaining integrity of the reactor coolant pressure boundary
- supporting primary containment isolation
- providing a flow path for HPCI and RCIC systems to inject water into the RPV.

2.3.4.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.2, UFSAR Sections 7.7, 10.2 and 10.4, and the applicable license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAI as discussed below.

In RAI 2.3.4.2-01, dated August 7, 2009, the staff noted license renewal drawing BECH-M111-LR (C-6 and D-6) shows reactor feed pump motor coolers #1E039A and #1E039B as not within scope for license renewal, however, these coolers are attached to general service water system piping which is identified as within scope for 10 CFR 54.4(a)(2). The applicant was requested to provide additional information to clarify the status of the reactor feed pump motor coolers on license renewal drawing BECH-M111-LR.

In its response dated September 3, 2009, the applicant stated the reactor feed pump motor coolers are an integral part of the reactor feed pump motors. The reactor feed pump motors are within scope for license renewal but were determined to be active components and are not subject to an AMR.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.2-01 acceptable because the applicant clarified the reactor feed pump motor coolers are within scope, but are active components and not subject to an AMR. Therefore, the staff's concern described in RAI 2.3.4.2-01 is resolved.

2.3.4.2.3 Conclusion

The staff reviewed the LRA, UFSAR, RAI response, and applicable license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant adequately identified the condensate and feedwater system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.3 Condenser and Condenser Air Removal System

2.3.4.3.1 Summary of Technical Information in the Application

LRA Section 2.3.4.3 describes the condenser and condenser air removal system. The main condenser is a two pass, divided water box type of dual pressure, deaerating design. The hotwell contains baffling to provide two minutes of radioactive decay time for short-lived isotopes. Two full capacity steam jet air ejectors, with inter- and after-condensables from the main condenser and direct it to the offgas system. The main steam line drains and the main condenser provide a main steam isolation valve leakage path designed to mitigate the release of fission products following a LOCA.

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

The intended functions of the condenser and condenser air removal system component types within the scope of license renewal include:

- Provide for plateout as part of MSIV leakage treatment path
- The system includes non-safety related SSCs whose failure could prevent satisfactory accomplishment of a safety-related function due to special proximity.

2.3.4.3.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.3, UFSAR Sections 6.7, 10.4.1, and 10.4.2, and the applicable license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

During its review, the staff evaluated the system functions described in the LRA and UFSAR to verify that the applicant 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 the requirements of 10 CFR 54.21(a)(1).

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 2.3.4.3-01, dated August 7, 2009, the staff noted license renewal drawing BECH-M103<1>-LR (A-2) shows line 1-inch-EBO-3 within scope for license renewal for 10 CFR 54.4(a)(2). However, the continuation of this 1-inch line on drawing BECH-M137<1>-LR (C3) shows this line is not within scope. The applicant was requested to provide additional information explaining why there is a difference in scope classification between drawing BECH-M103<1>-LR and the continuation on BECH-M105<1>-LR.

In its response dated September 3, 2009, the applicant stated line 1-inch-EBD-3 originates in the condenser bay and enters the turbine building sump room. The applicant provided the basis for the components in the turbine building sump room not being within scope for license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.3-01 acceptable because the applicant clarified the line in question was not within scope. Therefore, the staff's concern described in RAI 2.3.4.3-01 is resolved.

In RAI 2.3.4.3-02, dated August 7, 2009, the staff noted license renewal drawing BECH-M103<1>-LR (A-4) shows line 1½-inch-EBD-3 within scope for license renewal for 10 CFR 54.4(a)(2). However, the continuation of this 1½-inch line on drawing BECH-M105-LR (1) (E-6) shows this line is not within scope for 10 CFR 54.4(a)(2). The applicant was requested to provide additional information explaining why there is a difference in scope classification between drawing BECH-M103<1>-LR and the continuation on BECHM105<1>-LR.

In its response dated September 3, 2009, the applicant stated line 1½-inch-EBD-3 originates in the steam jet air ejector (SJAE) room and enters the condenser bay. The applicant explained why components in the SJAE room are not within scope for license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.3-02 acceptable because the applicant clarified the line in question was not within scope. Therefore, the staff's concern described in RAI 2.3.4.3-02 is resolved.

In RAI 2.3.4.3-03, dated August 7, 2009, the staff noted license renewal drawing BECH-M103<1>-LR (D-8) shows the 1-inch-EBD-8 line within scope for license renewal for 10 CFR 54.4(a)(2). However, the continuation of this 1-inch line on drawing BECH-M137<1>-LR (C3) shows this line is not within scope. The applicant was requested to provide additional information explaining why there is a difference in scope classification between drawing BECH-M103<1>-LR and the continuation on BECH-M137<1>-LR.

In its response dated September 3, 2009, the applicant stated line 1-inch-EBD-3 originates in the heater bay and enters the turbine building sump room. The applicant explained why components in the turbine building sump room are not within scope for license renewal.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.3-03 acceptable because the applicant clarified that the line in question was not within scope. Therefore, the staff's concern described in RAI 2.3.4.3-03 is resolved.

In RAI 2.3.4.3-04, dated August 7, 2009, the staff noted license renewal drawing BECH-M104<1>-LR (C-5) shows equipment as abandoned in place, however 3-inch piping is identified as within scope for 10 CFR 54.4(a)(2). The applicant was requested to provide additional information to clarify the mixing of "within scope" versus "abandoned in place" on license renewal drawing BECH-M104<1>-LR.

In its response dated September 3, 2009, the applicant stated, "The remainder of the steam seal piping within the "Abandoned In Place" border on drawing BECH-M204<1>-LR is in scope for 10 CFR 54(a)(2) and subject to aging management review because it is exposed to steam seal pressure."

Based on its review, the staff finds the applicant's response to RAI 2.3.4.3-04 acceptable because the applicant clarified that the piping in question was within scope. Therefore, the staff's concern described in RAI 2.3.4.3-04 is resolved.

2.3.4.3.3 Conclusion

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

2.3.4.4 Main Steam Isolation and Automatic Depressurization System

2.3.4.4.1 Summary of Technical Information in the Application

LRA Section 2.3.4.4 describes the main steam isolation and automatic depressurization system. The main steam isolation and automatic depressurization system includes the nuclear steam supply shutoff system, main steam downstream of the main steam isolation valves, and low-low set safety and relief valves. The system transports steam from the reactor vessel through the primary containment to the main turbine. The system supplies HPCI and RCIC turbines and provides overpressure protection for the reactor vessel.

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

The intended functions of the main steam isolation and automatic depressurization system within the scope of license renewal include:

- provide for plate out as part of MSIV leakage treatment path
- maintain integrity of reactor coolant pressure boundary up to and including the downstream main steam isolation valve
- provide steam to HPCI turbine and RCIC turbine

2.3.4.4.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.4, UFSAR Sections 5.4, 7.3.1, 10.2, and 10.3, and the applicable license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

The staff's review identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the staff's RAI as discussed below.

In RAI 2.3.4.4-01, dated August 7, 2009, the staff noted license renewal drawing BECH-M184-LR (F-4) shows "MAIN STEAM LINE 'A'" as out of scope for license renewal. However, drawing BECH-M114-LR shows these four main steam lines as within scope for 10 CFR 54.4(a)(1) and 10 CFR 54.4(a)(2). The applicant was requested to provide additional information explaining why there is a difference of scope classification between drawing BECH-M114-LR and the continuation on BECH-M184-LR.

In its response dated September 3, 2009, the applicant stated:

> Main Steam Line "A" on license renewal drawing BECH-M184-LR should have been colored red for the components CV4413 and all components upstream on MSL "A" to indicate it is in scope and subject to aging management review for 10 CFR 54.4(a)(1). The portion of MSL "A" downstream of CV4413 should have been colored green to indicate this portion of the steam line is in scope and subject to aging management review for CFR 54.4(a)(2).

Based on its review, the staff finds the applicant's response to RAI 2.3.4.4-01 acceptable because the applicant clarified that the piping and components in question were within scope. Therefore, the staff's concern described in RAI 2.3.4.4-01 is resolved.

2.3.4.4.3 Conclusion

The staff reviewed the LRA, UFSAR, RAI response, and applicable license renewal drawings to determine whether the applicant failed to identify any SSCs within the scope of license renewal. The staff finds no such omissions. In addition, the staff's review determined whether the applicant failed to identify any components subject to an AMR. The staff finds no such omissions. On the basis of its review, the staff concludes that there is reasonable assurance that the applicant adequately identified the main steam isolation and automatic depressurization system components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.4.5 Turbine

2.3.4.5.1 Summary of Technical Information in the Application

LRA Section 2.3.4.5 describes the Turbine system. The turbine system includes the main turbine, turbine steam seal, turbine lube oil, lube oil transfer, main generator gas control, and stator cooling system. The turbine is a GE 1800 rpm, tandem-compound, four flow, three casing, condensing, two stage reheat unit. The turbine consists of one high pressure shell and two double flow, low pressure shells. The steam from the high pressure shell is reheated with extracted steam and main steam in two stages prior to entering the low pressure sections.

LRA Table 2.3.4-5 identifies the component types within the scope of license renewal and subject to an AMR.

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

- provide main turbine first stage pressure sensing lines to reactor protection system pressure switches

- control steam pressure during plant transients

2.3.4.5.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.5, UFSAR Sections 7.7.2, 10.2 and 10.4.3, and the applicable license renewal drawings using the evaluation methodology described in SER Section 2.3 and the guidance in SRP-LR Section 2.3.

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

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 2.3.4.5-01, dated August 7, 2009, the staff noted license renewal drawing BECH-M145<1>-LR (E-5) shows the line downstream of valve V45-0268 out of scope for license renewal. However, the continuation of this line on the same drawing at location F-7 shows this line is within scope for 10 CFR 54.4(a)(2). The applicant was requested to provide additional information explaining why there is a difference in scope classification for the line on drawing BECH-M145<1>-LR.

In its response dated September 3, 2009, the applicant stated, "The line downstream of valve V45-0268 on license renewal drawing BECH-M145<1>-LR (E-5) should have been colored green to indicate that it is also in scope and subject to AMR for 10 CFR 54.4(a)(2)."

Based on its review, the staff finds the applicant's response to RAI 2.3.4.5-01 acceptable because the applicant clarified that the line in question was within scope. Therefore, the staff's concern described in RAI 2.3.4.5-01 is resolved.

In RAI 2.3.4.5-02, dated August 7, 2009, the staff noted license renewal drawing BECH-M145<4>-LR (E-7) shows "GBV VENT" as out of scope for license renewal, however this vent is attached to the "AIR DETRAINING SECTION" which is within scope for 10 CFR 54.4(a)(2). The applicant was requested to provide additional information to clarify the status of the vent line on license renewal drawing BECH-M145<4>-LR.

In its response dated September 3, 2009, the applicant stated, "The Main Lube Oil Detraining Section vent labeled as GBV VENT on license renewal drawing BECH-M145<4>-LR (E-7) is physically attached to the air detraining section. The line should have been colored green to indicate that it is also in scope and subject to AMR for 10 CFR 54.4(a)(2)."

Based on its review, the staff finds the applicant's response to RAI 2.3.4.5-02 acceptable because the applicant clarified the line in question was within scope. Therefore, the staff's concern described in RAI 2.3.4.5-02 is resolved.

In RAI 2.3.4.5-03, dated August 7, 2009, the staff noted license renewal drawing BECH-M111-LR (A-4) shows exciter air cooler 1E059 as out of scope for license renewal, however, this cooler is attached to general service water system piping which is within scope for 10 CFR 54.4(a)(2). The applicant was requested to provide additional information to clarify the status of the exciter air cooler on license renewal drawing BECH-M111-LR.

In its response dated September 3, 2009, the applicant stated the exciter air cooler, "…is a tube heat exchanger that is entirely contained within the main generator exciter housing. There is no safety-related equipment contained within the exciter housing…" Leaks from the exciter air cooler are prevented from spatially affecting safety-related equipment in the turbine building.

Based on its review, the staff finds the applicant's response to RAI 2.3.4.5-03 acceptable because the applicant explained that the exciter air cooler is entirely contained within the main generator exciter housing. Therefore, the staff's concern described in RAI 2.3.4.5-03 is resolved.

In RAI 2.3.4.5-04, dated August 7, 2009, the staff noted license renewal drawing BECH-M111-LR, (C-4 and D-4) shows four generator hydrogen coolers 1 E063A, B, C, and D as out of scope for license renewal; however, these coolers are attached to the general service water system piping which is identified as within scope for 10 CFR 54.4(a)(2). The applicant was requested to provide additional information to clarify the scope status of the generator hydrogen coolers on license renewal drawing BECH-M111-LR.

In its response dated September 3, 2009, the applicant stated the four generator hydrogen coolers, "…are tube heat exchangers that are entirely contained within the Main Generator Shell. [There] is no safety-related equipment contained within the Main Generator Shell, and any leaks from these heat exchangers would be prevented from spatially affecting safety-related equipment in the Turbine Building."

Based on its review, the staff finds the applicant's response to RAI 2.3.4.5-04 acceptable because the applicant clarified the four generator hydrogen coolers are entirely contained within the main generator shell and are prevented from spatially affecting safety-related equipment in the turbine building. Therefore, the staff's concern described in RAI 2.3.4.5-04 is resolved.

In RAI 2.3.4.5-05, dated August 7, 2009, the staff noted license renewal drawing BECH-M145<2>-LR (G-4) shows the generator frame as out of scope for license renewal, however, this cooler is attached to the stator winding cooling water system piping which is identified as within scope for 10 CFR 54.4(a)(2). The applicant was requested to provide additional information to clarify the scope status of the generator frame on license renewal drawing BECH-M145<2>-LR.

In its response dated September 3, 2009, the applicant stated, "…the Stator Winding Cooling Water components located within the Generator are not in scope for 10 CFR 54.4(a)(2) because they are contained in the Generator Frame. Should the components inside the frame fail, any spray will not affect safety-related equipment in the Turbine Building."

Based on its review, the staff finds the applicant's response to RAI 2.3.4.5-05 acceptable because the applicant clarified the stator winding cooling water components are located within the generator frame and are prevented from spatially affecting safety-related equipment in the turbine building. Therefore, the staff's concern described in RAI 2.3.4.5-05 is resolved.

2.3.4.5.3 Conclusion

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

2.4 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:

- buildings and structures affecting safety
- low-level radwaste processing facility
- machine shop
- off-gas retention building
- radwaste building

- railroad airlock
- control building
- cranes and hoists
- intake structure
- miscellaneous yard structures
- off-gas stack
- primary containment structure
- pump house
- reactor building
- supports
- turbine building

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

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

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

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

For those components with intended functions, the staff sought to determine: (1) if the functions are performed with moving parts or a change in configuration or properties, or (2) if they are subject to replacement based on a qualified life or specified time period, as described in 10 CFR 54.21(a)(1). For those that did not meet either of these criteria, the staff sought to confirm that these structural components were subject to an AMR, as required by 10 CFR 54.21(a)(1).

As stated previously, if discrepancies were identified, the staff requested additional information to resolve them.

2.4.1 Buildings and Structures Affecting Safety

2.4.1.1 Summary of Technical Information in the Application

LRA Section 2.4.1 describes the buildings and structures affecting safety. They are composed of the following structures:

Low-Level Radwaste Processing Facility. The low-level radwaste processing facility is described as being physically located next to the low-level radwaste storage building and adjacent, but separate, from the machine shop, railroad extension (truck bay), and the off-gas retention buildings. Constructed of concrete and steel, I main purpose of the facility is to house various components which process low-level radwaste.

Machine Shop. The machine shop is described as being physically adjacent, but separate, from the reactor building, low-level radwaste storage building, low-level radwaste processing facility, the off-gas retention building, and the railroad airlock. It is a single-story building constructed with steel and concrete at grade. The machine shop is divided into several areas, such as the general shop areas, tool room, maintenance office, toilet room, and decontamination area. All the facilities inside are serviced by a 5-ton overhead bridge crane.

Off-Gas Retention Building. The off-gas retention building is described as being physically adjacent to the low-level radwaste processing facility, machine shop, and the railroad airlock. It is a two-level concrete and steel structure that has one level below grade and one level above grade. Its main purpose is to house the principal components of the off-gas system.

Radwaste Building. The radwaste building is described as being physically adjacent, but separate, from the reactor building. Construction consists of steel and concrete. The purpose of the radwaste building is to house the various components of the radwaste system, as well as the control center for the radwaste system.

LRA Table 2.4-1 lists components and commodity groups of the buildings and structures affecting safety that require an AMR, including their intended functions.

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 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 buildings and structures affecting safety.

In RAI 2.4.2-2 dated September 17, 2009, the staff requested that the applicant provide additional information to confirm the inclusion or justify the exclusion from scope of the stoplogs located in the low-level radwaste building since they are not listed in LRA Table 2.4-1.

In its response dated October 1, 2009, the applicant stated that the stoplogs have not been excluded from the scope of license renewal.

The response also stated that the steel stoplogs are staged/stored equipment that are not permanently installed in their associated structures and are stored in a warehouse until needed.

In a teleconference dated November 12, 2009, the applicant clarified that the steel stoplogs are only used for flood barriers at the low-level radwaste storage and processing building, which is not required for safe shutdown. Additionally, the applicant clarified that the line item for steel stoplogs in Table 3.5.2-5 only includes steel bracing, brackets, etc., used to install the treated wood stoplogs.

Based on its review, the staff finds the response to RAI 2.4.2-2 acceptable because the stoplogs located in the low-level radwaste building have been reviewed and justified for exclusion of the scope of license renewal and not subject to an AMR. Therefore, the staff's concern described in RAI 2.4.2-2 is resolved.

2.4.1.3 Conclusion

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

2.4.2 Control Building

2.4.2.1 Summary of Technical Information in the Application

LRA Section 2.4.2 describes the control building as a concrete and steel structure that is adjacent to, but physically separate from the reactor and turbine buildings. The control building structure is part of the pressurized boundary.

The purpose of the control building is to house and provide protection/support to safety-related systems and equipment, such as the control room and associated auxiliaries, switchgear, battery rooms, and the cable spreading room. It also provides habitability for personnel and equipment in the event of a LOCA or a hazardous chemical release.

Additionally, nonsafety-related SSCs that could impact safety-related SSCs are located in the control building.

LRA Table 2.4-2 lists the components and commodity groups of the control building that require an AMR, including their intended functions.

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 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 control building.

In RAI 2.4.2-1 dated September 17, 2009, the staff requested that the applicant provide additional information to confirm the inclusion or justify the exclusion from scope of the stoplogs located in the control building access door #421, since they are not listed in LRA Table 2.4-2.

In its response dated October 1, 2009, the applicant stated that the stoplogs have not been excluded from the scope of license renewal. The response also stated that the stoplogs are staged/stored equipment that are not permanently installed in their associated structures and are stored in a warehouse until needed. Additionally, the applicant stated that wooden stoplogs are creosoted for their preservation and no aging effects have been identified. The applicant further stated that the treated wood did not require an AMR. The staff disagreed with this statement and further clarification was requested.

During a teleconference on November 12, 2009, the applicant stated that the subject wood timbers, treated with creosote and stored indoors, would last "well in excess of the plant life." Subsequently, the applicant provided two references as background information to justify that the treated wood did not require an AMR. However, after reviewing the applicant's information, the staff requested further clarification. In a teleconference dated January 13, 2010, the applicant agreed to review additional operating experience and search additional information in order to determine the need to implement a Structures Monitoring Program to manage an aging effect of the wooden timber stoplogs. By letter dated January 14, 2010, the applicant agreed to implement a Structures Monitoring Program to manage the aging effect requiring management for the wooden timber stoplogs.

Based on its review, the staff finds the response to RAI 2.4.2-1 acceptable because the stoplogs located in the control building access door #421 that prevent the battery rooms and switchgear from flooding have not been excluded from the scope of license renewal and are subject to an AMR. Therefore, the staff's concern described in RAI 2.4.2-1 is resolved.

2.4.2.3 Conclusion

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

2.4.3 Cranes and Hoists

2.4.3.1 Summary of Technical Information in the Application

LRA Section 2.4.3 describes the cranes and hoists as overhead handling systems and equipment in which a load drop could result in damage to key plant components, such as irradiated fuel, plant shutdown systems, and/or decay heat removal systems.

In addition to the cranes and hoists, some components have been added within the scope of license renewal due to their proximity to the reactor vessel and the spent fuel pool. Some examples of systems and equipment in-scope include, but are not limited to:

- reactor building crane
- turbine building crane
- recirculation pump motor hoist
- drywell equipment hatch hoist
- torus monorail
- refueling platform
- refuel pool jib crane
- south torus equipment hatch hoist

LRA Section 2.4.3 describes hoists as active components in the review and, therefore, do not require an AMR.

LRA Table 2.4-3 lists the components and commodity groups of the cranes and hoists that require an AMR, including their intended functions.

2.4.3.2 Conclusion

The staff followed the evaluation methodology discussed in SER Section 2.4 and reviewed the LRA and UFSAR 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 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 adequately identified the cranes and hoists and their SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1)

2.4.4 Intake Structure

2.4.4.1 Summary of Technical Information in the Application

LRA Section 2.4.4 describes the intake structure as a reinforced-concrete structure located on the west bank of the Cedar River. The underground portion of the intake structure serves as channels for incoming water and the upper portions enclose the motors and controls. Also, since the Seismic Category I equipment located in the intake structure is located above the peak stage of the flood for the Cedar River, no flood protection is required.

The purpose of the intake structure is to house and contain the pumps for the plant makeup water, the trash rake, traveling screens, and stoplogs.

LRA Table 2.4-4 lists the components and commodity groups of the intake structure that require an AMR, including their intended functions.

2.4.4.2 Conclusion

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

2.4.5 Miscellaneous Yard Structures

2.4.5.1 Summary of Technical Information in the Application

LRA Section 2.4.5 describes the miscellaneous yard structures as being composed of the yard and substation structures, the condensate storage tank foundations, the emergency diesel generator fuel oil tank anchors, circulating water dilution structure, and the underground duct banks and manholes containing safety-related circuitry. The structures include steel structures and their concrete foundations. All structures are located outside the power block and auxiliary buildings.

The purpose of the various miscellaneous yard structures is, but not limited to, support and protection of safety-related electrical components required for safe shutdown, support and protection to the safety-related emergency diesel oil tank, as well as support for structures and components.

LRA Table 2.4-5 lists the components and commodity groups of the miscellaneous yard structures that require an AMR, including their intended functions.

2.4.5.2 Conclusion

The staff followed the evaluation methodology discussed in SER Section 2.4 and reviewed the LRA and UFSAR 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 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 adequately identified the miscellaneous yard structures and their SCs within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.6 Off-Gas Stack

2.4.6.1 Summary of Technical Information in the Application

LRA Section 2.4.6 describes the off-gas stack structure as being physically located more than 100 meters from the nearest Seismic Category I structure or equipment and designed in accordance with the criteria for Seismic Category I structures. Additionally, the structure is fitted with required appurtenances, such as aviation obstruction lights and radiation monitoring instruments.

The purpose of the off-gas stack is to discharge gases to the atmosphere from the SGTS and off-gas exhaust systems.

LRA Table 2.4-6 lists the components and commodity groups of the off-gas stack that require an AMR, including their intended functions.

2.4.6.2 Conclusion

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

2.4.7 Primary Containment Structure

2.4.7.1 Summary of Technical Information in the Application

LRA Section 2.4.7 describes the primary containment structure as a Mark I containment system. It is composed of a drywell and a pressure suppression chamber (torus). They are connected through a vent system which directs flow from the drywell into the suppression water through submerged downcomers.

The purpose of the drywell is to house the reactor vessel, reactor coolant recirculation loops, and the reactor coolant system. The purpose of the suppression chamber is to provide a source of water for the emergency core cooling systems. Additionally, it is also a heat sink in the event of a LOCA.

LRA Table 2.4-7 lists the components and commodity groups of the primary containment structure that require an AMR, including their intended functions.

2.4.7.2 Conclusion

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

2.4.8 *Pump House*

2.4.8.1 Summary of Technical Information in the Application

LRA Section 2.4.8 describes the pump house as a single-level reinforced concrete structure constructed over a two-compartment basin. The pump house portion that contains the emergency service and the RHR service water pumps is classified as Seismic Category I.

Also, all stoplogs, caulking, and bracing required for flood protection is maintained at the site.

The purpose of the pump house is to house the circulating water pumps, general service water pumps, fire pump, emergency service water pumps, and RHR service water pumps within its basins.

LRA Table 2.4-8 lists the components and commodity groups of the pump house that require an AMR, including their intended functions.

2.4.8.2 Staff Evaluation

The staff reviewed LRA Section 2.4.8 using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4.

During its review of LRA Section 2.4.8, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the pump house.

In RAI 2.4.8-1 dated September 17, 2009, the staff requested that the applicant provide additional information to confirm the inclusion or justify the exclusion from scope of the stoplogs located in the pump house door #500 that prevent water from entering the emergency and RHR service water pump areas since they are not listed in LRA Table 2.4-8.

In its response to the RAI dated October 1, 2009, the applicant stated that the stoplogs have not been excluded from the scope of license renewal. The response also stated that the stoplogs are staged/stored equipment that are not permanently installed in their associated structures and are stored in a warehouse until needed. Additionally, the applicant stated that wooden stoplogs are creosoted for their preservation and no aging effects have been identified. The applicant further stated that the treated wood did not require an AMP. The staff disagreed with this statement and further clarification was requested.

During a teleconference on November 12, 2009, the applicant stated that the subject wood timbers, treated with creosote and stored indoors, would last "well in excess of the plant life." Subsequently, the applicant provided two references as background information to justify that the treated wood did not require an AMP. However, after reviewing the applicant's information, the staff requested further clarification. In a teleconference dated January 13, 2010, the applicant agreed to review additional operating experience and search additional information in order to determine the need to implement a Structures Monitoring Program to manage an aging effect of the wooden timber stoplogs. By letter dated January 14, 2010, the applicant agreed to implement a Structures Monitoring Program to manage the aging effect requiring management of the wooden timber stoplogs.

Based on its review, the staff finds the response to RAI 2.4.8-1 acceptable because the stoplogs located in the pump house door #500 that prevent water from entering the emergency and RHR service water pump areas have not been excluded from the scope of license renewal and are subject to an AMR. Therefore, the staff's concern described in RAI 2.4.8-1 is resolved.

2.4.8.3 Conclusion

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

2.4.9 Reactor Building

2.4.9.1 Summary of Technical Information in the Application

LRA Section 2.4.9 describes the reactor building as a reinforced concrete structure. However, above the refueling floor, the reactor building is a steel rigid frame structure. The steel frame supports the roofing and a 100-ton traveling bridge crane.

The purpose of the reactor building is to enclose the reactor, primary containment, spent fuel storage pools, and other auxiliary systems associated with the nuclear steam supply system.

Additionally, it provides secondary containment for the reactor when in service and primary containment for the auxiliary systems and the reactor during periods when the primary containment is open for refueling or servicing.

LRA Table 2.4-9 lists the components and commodity groups of the pump house that require an AMR, including their intended functions.

2.4.9.2 Conclusion

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

2.4.10 *Supports*

2.4.10.1 Summary of Technical Information in the Application

LRA Section 2.4.10 describes the supports as the connection between a system's equipment or component and a plant structural member. The supports commodity group includes:

- <u>Pipe supports/restraints tube track, and instrument tubing supports</u>. Described as all the items used for supporting and/or restraining piping and components, tube tracks, and instrument tubing.
- <u>Equipment supports</u>. Described as the structural steel, sliding surfaces, fasteners, and vibration mounts that secure equipment to structures.
- <u>Ventilation ductwork supports</u>. Described as the structural steel and fasteners that support/attach ventilation ductwork to structures.

- Raceways. Described as including the component as well as both the component's supports and attachments that are designed specifically for holding electrical wires and cables.

- Electrical enclosures. Described as a generic component type that contains electrical components such as conduit, panels, and boxes. The enclosure includes both the enclosure and its supports and attachments.

- Platform and masonry wall supports. Described as including the structural steel and fasteners that secure the platforms and masonry walls to structures.

The purpose of the supports is to provide support for distributed loads (e.g., piping, tubing, and ventilation ductwork) and localized loads (e.g., individual equipment).

LRA Table 2.4-10 lists the components and commodity groups of the supports that require an AMR, including their intended functions.

2.4.10.2 Conclusion

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

2.4.11 Turbine Building

2.4.11.1 Summary of Technical Information in the Application

LRA Section 2.4.11 describes the turbine building as a steel and concrete structure that is composed of a steel superstructure of rigid frame construction in the main turbine house and of braced framed construction in the auxiliary bay. The turbine building has a rigid frame that supports the runway for a 125-ton crane.

The purpose of the turbine building is to house the turbine generator and other components of the power conversion system. Additionally, the turbine building houses the standby diesel generators and the plant heating boiler and associated auxiliaries.

LRA Table 2.4-11 lists the components and commodity groups of the turbine building that require an AMR, including their intended functions.

2.4.11.2 Staff Evaluation

The staff reviewed LRA Section 2.4.11 using the evaluation methodology described in SER Section 2.4 and the guidance in SRP-LR Section 2.4.

During its review of LRA Section 2.4.11, the staff identified areas in which additional information was necessary to complete the evaluation of the applicant's scoping and screening results for the turbine building.

In RAI 2.4.11-1 dated September 17, 2009, the staff requested that the applicant provide additional information to confirm the inclusion or justify the exclusion from scope of the stoplogs located in the turbine building that prevent water from flooding the building, since they are not listed in LRA Table 2.4-11.

In its response dated October 1, 2009, the applicant stated that the stoplogs have not been excluded from the scope of license renewal. The response also stated that the stoplogs are staged/stored equipment that are not permanently installed in their associated structures and are stored in a warehouse until needed. Additionally, the applicant stated that wooden stoplogs are creosoted for their preservation and no aging effects have been identified. The applicant further stated that the treated wood did not require an AMP. The staff disagreed with this statement and further clarification was requested.

During a teleconference on November 12, 2009, the applicant stated that the subject wood timbers, treated with creosote and stored indoors, would last "well in excess of the plant life." Subsequently, the applicant provided two references as background information to justify that the treated wood did not require an AMP. However, after reviewing the applicant's information, the staff requested further clarification. In a teleconference dated January 13, 2010, the applicant agreed to review additional operating experience and search additional information in order to determine the need to implement a Structures Monitoring Program to manage an aging effect of the wooden timber stoplogs. By letter dated January 14, 2010, the applicant agreed to implement a Structures Monitoring Program to manage the aging effect requiring management for the wooden timber stoplogs.

Based on its review, the staff finds the response to RAI 2.4.11-1 acceptable because the stoplogs located in the turbine building that prevent water from flooding the building, have not been excluded from the scope of license renewal and are subject to an AMR. Therefore, the staff's concern described in RAI 2.4.11-1 is resolved.

2.4.11.3 Conclusion

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

2.5 <u>Scoping and Screening Results: Electrical and Instrumentation and Controls</u>

This section documents the staff's review of the applicant's scoping and screening results for electrical and instrumentation and controls (I&C) systems. Specifically, this section discusses:

- electrical and I&C component commodity groups

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

The staff's evaluation of the information in the LRA was the same for all electrical and I&C systems. The objective was to determine whether or not the applicant identified, in accordance with 10 CFR 54.4, components and supporting structures for electrical and I&C systems that appear to meet the license renewal scoping criteria. Similarly, the staff evaluated the applicant's screening results to verify that all passive, long-lived components were subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

In its scoping evaluation, the staff reviewed the applicable LRA sections and the RAI response dated September 3, 2009, focusing on components that were not identified as within the scope of license renewal. The staff reviewed the UFSAR for each electrical and I&C system to determine whether or not the applicant 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 whether: (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, as described in 10 CFR 54.21(a)(1). For those meeting neither of these criteria, the staff sought to confirm that these SSCs were subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.5.1 Electrical and Instrumentation and Controls Commodity Groups

2.5.1.1 Summary of Technical Information in the Application

LRA Section 2.5 describes the electrical and I&C systems/components. Interface of these components with mechanical or civil/structural components and active electrical components with passive mechanical functions are covered in the mechanical or civil/structural sections. The scoping method includes identifying the electrical/I&C systems and their design functions and reviewing them against criteria contained in 10 CFR 54.4. Those electrical and I&C components that were identified to be within the scope of license renewal have been grouped by the applicant into component commodity groups. The applicant applied the screening criteria in 10 CFR 54.21(a)(1)(i) and (a)(1)(ii) to this list of component commodity groups to identify those that perform their intended functions without moving parts or without a change in configuration or properties, and to remove the component commodity groups that are subject to replacement based on a qualified life or specified time period. The following list identifies the component commodity groups that are subject to an AMR and their intended functions:

- electrical conductors — function of electrical continuity
- transmission conductors and connections
- insulated cables and connections
- electrical Connections
- fuse holders
- switchyard bus and connections
- metal-enclosed bus

- electrical penetration assemblies excluded from the scope of the EQ Program — function of electrical continuity
- high-voltage insulators — function to insulate and support an electrical conductor

2.5.1.2 Staff Evaluation

The staff reviewed LRA Section 2.5 and UFSAR Sections 7 and 8 using the evaluation methodology described in SER Section 2.5 and the guidance in SRP-LR Section 2.5, “Scoping and Screening Results: Electrical and Instrumentation and Controls Systems.”

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

General Design Criteria 17 of 10 CFR Part 50, Appendix A, requires that electric power from the transmission network to the onsite electric distribution system be supplied by two physically independent circuits to minimize the likelihood of their simultaneous failure. In addition, the staff noted that the guidance provided by letter dated April 1, 2002, “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)),” 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 during the period of extended operation.

The applicant included the complete circuits between the onsite circuits and up to and including switchyard breakers (which includes the associated controls and structures) supplying the startup transformer and the standby transformer within the scope of license renewal. The preferred offsite power is fed through the startup transformer by means of two paths. Path A is fed from the west 161-kV switchyard bus to the essential switchgear (1A3 and 1A4) through the 161-kV breaker CB5560 (breaker K), while path B is fed from the east 161-kV switchyard bus to the essential switchgear (1A3 and 1A4) through the breaker CB5550 (breaker J). These breakers are the scoping boundary for the preferred source of offsite power. The secondary source of offsite power is fed from the 36-kV switchyard bus to the essential switchgear (1A3 and 1A4) through the breaker CB8490 (breaker M) and through the standby transformer. This breaker is the scoping boundary for the secondary source of offsite power. Consequently, the staff concludes that the scoping is consistent with the guidance issued April 1, 2002, which was later incorporated in SRP-LR Section 2.5.2.1.1.

In RAI 2.5-1 dated August 07, 2009, the staff requested that the applicant provide justification as to why LRA Section 2.5 does not include elements such as resistance temperature detectors, sensors, thermocouples, and transducers in the list of components and/or commodity groups subject to an AMR if a pressure boundary is applicable. In its response dated September 03, 2009, the applicant stated that instrumentation with a pressure boundary application was included in the mechanical AMR and is managed by mechanical AMPs. Furthermore, the license states that the electrical functions of the instrumentation are active functions and screen out from being part of the AMR. Based on the fact that the instrumentation with a pressure boundary application is part of the mechanical scoping and screening process, and that the instrumentation has an active electrical function which screens out of the electrical scoping per 10 CFR 54.4, the staff finds the applicant's response to RAI 2.5-1 acceptable. Therefore, the staff's concern described in RAI 2.5-1 is resolved.

2.5.1.3 Conclusion

The staff reviewed the LRA, the UFSAR, 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 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 adequately

identified the electrical and I&C systems/components within the scope of license renewal, as required by 10 CFR 54.4(a), and those subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.6 <u>Conclusion for Scoping and Screening</u>

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

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

The staff concludes that there is reasonable assurance that the applicant will continue to conduct the activities authorized by the renewed license in accordance with the CLB and any changes to the CLB in order to comply with 10 CFR 54.21(a)(1), in accordance with the Atomic Energy Act of 1954, as amended, and NRC regulations.

SECTION 3

AGING MANAGEMENT REVIEW RESULTS

This section of the safety evaluation report (SER) evaluates aging management programs (AMPs) and aging management reviews (AMRs) for Duane Arnold Energy Center (DAEC), by the staff of the United States (U.S.) Nuclear Regulatory Commission (NRC) (the staff).

In Appendix B of its license renewal application (LRA), Florida Power and Light Energy Duane Arnold, LLC (FPL-DA or the applicant) described the 41 AMPs that it relies on to manage or monitor the aging of passive, long-lived structures and components (SCs).

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

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

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

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

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

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

The staff's review was in accordance with Title 10, Part 54, of the *Code of Federal Regulations* (10 CFR Part 54), "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," and the guidance of the SRP-LR and the GALL Report.

In addition to its review of the LRA, the staff conducted an onsite audit of selected AMRs and associated AMPs during the week of August 10, 2009. The onsite audits and reviews are designed for maximum efficiency of the staff's LRA review. The applicant can respond to questions, the staff can readily evaluate the applicant's responses, the need for formal correspondence between the staff and the applicant is reduced, and the result is an improvement in review efficiency.

3.0.1 Format of the License Renewal Application

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

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

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

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

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

3.0.1.1 Overview of Table 1s

Each Table 1 summarizes and compares how the facility aligns with the corresponding tables in the GALL Report. The tables are essentially the same as Tables 1 through 6 in the GALL Report, except that the "Type" column has been replaced by an "Item Number" column and the "Item Number in GALL" column has been replaced by a "Discussion" column. The "Item Number" column is a means for the staff reviewer to cross-reference Table 2s with Table 1s. In the "Discussion" column the applicant provided clarifying information.

The following are examples of information that might be contained within this column:

- further evaluation recommended – information or reference to where that information is located
- name of a plant-specific program
- exceptions to GALL Report assumptions
- discussion of how the line is consistent with the corresponding line item in the GALL Report when the consistency may not be obvious
- discussion of how the item is different from the corresponding line item in the GALL Report (e.g., when an exception is taken to a GALL Report AMP)

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

3.0.1.2 Overview of Table 2s

Each Table 2 provides the detailed results of the AMRs for components identified in LRA Section 2 as subject to an AMR. The LRA has a Table 2 for each of the systems or structures within a specific system grouping (e.g., reactor coolant system (RCS), engineered safety features (ESFs), auxiliary systems, etc.). For example, the ESF group has tables specific to the core spray system, high-pressure coolant injection system, and residual heat removal system. Each Table 2 consists of nine columns:

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

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

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

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

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

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

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

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

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

3.0.2 Staff's Review Process

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

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

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

    The SRP-LR states that an applicant may take one or more exceptions to specific GALL AMP elements; however, any deviation from or exception to the GALL AMP should be described and justified. Therefore, the staff considers exceptions as being portions of the GALL AMP that the applicant does not intend to implement.

    In some cases, an applicant may choose an existing plant program that does not meet all the program elements defined in the GALL AMP. However, the applicant may make a commitment to augment the existing program to satisfy the GALL AMP prior to the period of extended operation. Therefore, the staff considers these augmentations or additions to be enhancements. Enhancements include, but are not limited to, activities needed to ensure consistency with the GALL Report recommendations. Enhancements may expand, but not reduce, the scope of an AMP.

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

Staff audits and technical reviews of the applicant's AMPs and AMRs determine whether the aging effects on SCs can be adequately managed to maintain their intended functions consistent with the plant's current licensing basis (CLB) for the period of extended operation, as required by 10 CFR Part 54.

3.0.2.1 Review of AMPs

For AMPs for which the applicant claimed consistency with the GALL AMPs, the staff conducted either an audit or a technical review to verify the claim. For each AMP with one or more deviations, the staff evaluated each deviation to determine whether the deviation was acceptable and whether the modified AMP would adequately manage the aging effect(s) for which it was credited. For AMPs not evaluated in the GALL Report, the staff performed a full review to determine their adequacy. The staff evaluated the AMPs against the following ten program elements defined in SRP-LR Appendix A:

(1) Scope of the Program – Scope of the program should include the specific SCs subject to an AMR for license renewal.

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

(3) Parameters Monitored or Inspected – Parameters monitored or inspected should be linked to the degradation of the particular structure or component intended 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 of the AMP, including past corrective actions resulting in program enhancements or additional programs, should provide objective evidence to support the conclusion that the effects of aging will be adequately managed so that the SC intended functions will be maintained during the period of extended operation.

Details of the staff's audit evaluation of program elements (1) through (6) are documented in SER Section 3.0.3.

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

The staff reviewed the information on the "operating experience" program element and documented its evaluation in SER 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," correlates to an AMR combination as identified in the GALL Report. The staff also conducted onsite audits to verify these correlations. A blank column seven indicates that the applicant was unable to identify an appropriate correlation in the GALL Report. The staff also conducted a technical review of combinations not consistent with the GALL Report. The next column, "Table 1 Item," refers to a number indicating the correlating row in Table 1.

3.0.2.3 UFSAR Supplement

Consistent with the SRP-LR for the AMRs and AMPs that it reviewed, the staff also reviewed the updated final safety analysis report (UFSAR) supplement, which summarizes the applicant's programs and activities for managing aging effects for the period of extended operation, as required by 10 CFR 54.21(d).

3.0.2.4 Documentation and Documents Reviewed

In its review, the staff used the LRA, LRA supplements, the SRP-LR, and the GALL Report. During the onsite audit, the staff also examined the applicant's justifications to verify that the applicant's activities and programs will adequately manage the effects of aging on SCs. The staff also conducted detailed discussions and interviews with the applicant's license renewal project personnel and others with technical expertise relevant to aging management.

3.0.3 Aging Management Programs

SER Table 3.0.3-1 presents the AMPs credited by the applicant and described in LRA Appendix B. The table also indicates the SSCs that credit the AMPs and the GALL AMP with which the applicant claimed consistency and shows the section of this SER in which the staff's evaluation of the program is documented.

Table 3.0.3-1 Duane Arnold Energy Center Aging Management Programs

Applicant AMP	LRA Sections	New or Existing Program	Applicant Comparison to the GALL Report	GALL Report AMPs	SER Section
10 CFR Part 50 Appendix J Program	B.3.1 18.1.1	Existing	Consistent	XI.S4, 10 CFR 50, Appendix J	3.0.3.1.1
Aboveground Steel Tanks Program	B.3.2 18.1.2	Existing	Consistent	XI.M29, Aboveground Steel Tanks	3.0.3.1.2
ASME Section XI Inservice Inspection, IWB, IWC, and IWD Program	B.3.3 18.1.3	Existing	Consistent	XI.M1, ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	3.0.3.1.3
ASME Section XI Inservice Inspection, IWE Program	B.3.4 18.1.4	Existing	Consistent	XI.S1, ASME Section XI, Subsection IWE	3.0.3.1.4

Applicant AMP	LRA Sections	New or Existing Program	Applicant Comparison to the GALL Report	GALL Report AMPs	SER Section
ASME Section XI Inservice Inspection, Industrial Waste Filtration (IWF) Program	B.3.5 18.1.5	Existing	Consistent	XI.S3, ASME Section XI, Subsection IWF	3.0.3.1.5
Bolting Integrity Program	B.3.6 18.1.6	Existing	Consistent	XI.M18, Bolting Integrity	3.0.3.1.6
Buried Piping and Tanks Inspection Program	B.3.7 18.1.7	New	Consistent	XI.M34, Buried Piping and Tanks Inspection	3.0.3.1.7
BWR) Control Rod Drive (CRD) Return Line Nozzle Program	B.3.8 18.1.8	Existing	Consistent	XI.M6, BWR Control Rod Drive Return Line Nozzle	3.0.3.1.8
BWR Feedwater Nozzle Program	B.3.9 18.1.9	Existing	Consistent	XI.M5, BWR Feedwater Nozzle	3.0.3.1.9
BWR Penetrations Program	B.3.10 18.1.10	Existing	Consistent	XI.M8, BWR Penetrations	3.0.3.1.10
BWR Reactor Water Cleanup System Program	B.3.11 18.1.11	Existing	Consistent with Exception	XI.M25, BWR Reactor Water Cleanup System	3.0.3.2.1
BWR Stress Corrosion Cracking Program	B.3.12 18.1.12	Existing	Consistent	XI.M7, BWR Stress Corrosion Cracking	3.0.3.1.11
BWR Vessel Inside Diameter (ID) Attachment Welds Program	B.3.13 18.1.13	Existing	Consistent	XI.M4, BWR Vessel ID Attachment Welds	3.0.3.1.12
BWR Vessel Internals Program	B.3.14 18.1.14	Existing	Consistent with Enhancements	XI.M9, BWR Vessel Internals	3.0.3.2.2
Closed-Cycle Cooling Water System Program	B.3.15 18.1.15	Existing	Consistent	XI.M21, Closed-Cycle Cooling Water System	3.0.3.1.13
Compressed Air Monitoring Program	B.3.16 18.1.16	Existing	Consistent	XI.M24, Compressed Air Monitoring	3.0.3.1.14
Electrical Cables and Connections Program	B.3.17 18.1.17	New	Consistent	XI.E1, Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	3.0.3.1.15
Electrical Cables and Connections Used in Instrumentation Circuits Program	B.3.18 18.1.18	New	Consistent	XI.E2, Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	3.0.3.1.16
Electrical Connections Program	B.3.19 18.1.19	New	Plant-Specific		3.0.3.3.1
Electrical Penetration Assemblies Program	B.3.20 18.1.20	New	Plant-Specific		3.0.3.3.2

Applicant AMP	LRA Sections	New or Existing Program	Applicant Comparison to the GALL Report	GALL Report AMPs	SER Section
External Surfaces Monitoring Program	B.3.21 18.1.21	Existing	Consistent with Enhancements	XI.M36, External Surfaces Monitoring	3.0.3.2.3
Fire Protection Program	B.3.22 18.1.22	Existing	Consistent with Enhancements and an Exception	XI.M26, Fire Protection	3.0.3.2.4
Fire Water System Program	B.3.23 18.1.23	Existing	Consistent with Enhancements	XI.M27, Fire Water System	3.0.3.2.5
Flow-Accelerated Corrosion Program	B.3.24 18.1.24	Existing	Consistent	XI.M17, Flow-Accelerated Corrosion	3.0.3.1.17
Fuel Oil Chemistry Program	B.3.25 18.1.25	Existing	Consistent with Exceptions and Enhancements	XI.M30, Fuel Oil Chemistry	3.0.3.2.6
Fuse Holders Program	B.3.26 18.1.26	New	Consistent	XI.E5, Fuse Holders	3.0.3.1.18
Inaccessible Medium-Voltage Cables Program	B.3.27 18.1.27	New	Consistent	XI.E3, Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	3.0.3.1.19
Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	B.3.28 18.1.28	New	Consistent	XI.M38, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	3.0.3.1.20
Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program	B.3.29 18.1.29	Existing	Consistent with Enhancements	XI.M23, Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	3.0.3.2.7
Lubricating Oil Analysis Program	B.3.30 18.1.30	Existing	Consistent with Enhancement	XI.M39, Lubricating Oil Analysis	3.0.3.2.8
Metal-Enclosed Bus Program	B.3.31 18.1.31	New	Consistent with Exception	XI.E4, Metal-Enclosed Bus	3.0.3.2.9
One-Time Inspection Program	B.3.32 18.1.32	New	Consistent	XI.M32, One-Time Inspection	3.0.3.1.21
Open-Cycle Cooling Water System Program	B.3.33 18.1.33	Existing	Consistent	XI.M20, Open-Cycle Cooling Water System	3.0.3.1.22
Reactor Head Closure Studs Program	B.3.34 18.1.34	Existing	Consistent	XI.M3, Reactor Head Closure Studs	3.0.3.1.23
Reactor Vessel Surveillance Program	B.3.35 18.1.35	Existing	Consistent with Enhancements	XI.M31, Reactor Vessel Surveillance	3.0.3.2.10
Selective Leaching of Materials Program	B.3.36 18.1.36	New	Consistent	XI.M33, Selective Leaching of Materials	3.0.3.1.24

Applicant AMP	LRA Sections	New or Existing Program	Applicant Comparison to the GALL Report	GALL Report AMPs	SER Section
Structures Monitoring Program	B.3.37 18.1.37	Existing	Consistent with Enhancements	X.S5, Masonry Wall Program XI.S6, Structures Monitoring Program XI.S7, Regulatory Guide (RG) 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	3.0.3.2.11
Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program	B.3.38 18.1.38	New	Consistent	XI.M13, Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)	3.0.3.1.25
Water Chemistry Program	B.3.39 18.1.39	Existing	Consistent	XI.M2, Water Chemistry	3.0.3.1.26
Environmental Qualification (EQ) Program	B.4.1 18.2.1	Existing	Consistent	X.E1, Environmental Qualification (EQ) of Electric Components	3.0.3.1.27
Metal Fatigue of Reactor Coolant Pressure Boundary Program	B.4.2 18.2.2	Existing	Consistent with Enhancement	X.M1, Metal Fatigue of Reactor Coolant Pressure Boundary	3.0.3.2.12

3.0.3.1 AMPs Consistent with the GALL Report

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

- 10 CFR Part 50 Appendix J Program
- Aboveground Steel Tanks Program
- ASME Section XI Inservice Inspection, IWB, IWC, and IWD Program
- ASME Section XI Inservice Inspection, IWE Program
- ASME Section XI Inservice Inspection, IWF Program
- Bolting Integrity Program
- Buried Piping and Tanks Inspection Program
- BWR CRD Return Line Nozzle Program
- BWR Feedwater Nozzle Program

- BWR Penetrations Program
- BWR Vessel ID Attachment Welds Program
- Closed-Cycle Cooling Water System Program
- Compressed Air Monitoring Program
- Electrical Cables and Connections Program
- Electrical Cables and Connections Used in Instrumentation Circuits Program
- Flow-Accelerated Corrosion Program
- Fuse Holders Program
- Inaccessible Medium-Voltage Cables Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- One-Time Inspection Program
- Open-Cycle Cooling Water System Program
- Reactor Head Closure Studs Program
- Selective Leaching Program
- Thermal Aging and Neutron Irradiation Embrittlement of CASS Program
- Water Chemistry Program
- EQ Program

3.0.3.1.1 10 CFR Part 50 Appendix J Program

Summary of Technical Information in the Application. LRA Section B.3.1 describes the existing 10 CFR Part 50, Appendix J Program as consistent with GALL AMP XI.S4, "10 CFR Part 50, Appendix J." The applicant stated that the program manages the effects of aging of the primary reactor containment and systems and components penetrating primary containment. Periodic inspections and surveillance testing of primary containment, and systems and components penetrating primary containment are performed to ensure that allowable leakage rate values specified in the DAEC technical specifications are not exceeded. The applicant further stated that testing frequencies are in accordance with 10 CFR Part 50, Appendix J. 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, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.S4. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.S4. Based on its audit, the staff finds that elements one through six of the applicant's 10 CFR Part 50 Appendix J Program are consistent with the corresponding program elements of GALL AMP XI.S4 and, therefore, acceptable.

Operating Experience. LRA Section B.3.1 summarizes operating experience related to the 10 CFR Part 50, Appendix J Program. In the LRA, the applicant described the results of the most recent required integrated and local leak rate tests, which were completed in 2007 during refueling outage (RFO) 20. The applicant provided the results of these test as follows:

- The Type A test had "as found" leakage of 0.3552 percent wt/day with an acceptance criteria of 2.0 percent wt/day.
- There were no Type B failures during RFO 20. The airlock, including the equalizing valve, was tested and found to have a combined leakage of 3,855 standard cubic centimeter per minute (SCCM) which is equal to approximately 21 percent of the plant technical specification acceptance criteria of 0.05 La or 18,300 SCCM.
- The Type C tests (isolation valve testing) found acceptable leakage and identified general individual containment isolation valves that warranted maintenance.

The applicant further stated that the "as-left" leakage for penetrations subject to Type B and C tests was 0.22 La and the limit is 0.60 La. The staff noted that the operating experience demonstrates that the Appendix J Program is effective in detecting and repairing degraded containment valves and maintaining containment leakage within acceptable limits.

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

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

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

UFSAR Supplement. LRA Section A.18.1.1 provides the UFSAR supplement for the 10 CFR Part 50 Appendix J Program. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.5-2.

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

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

3.0.3.1.2 Aboveground Steel Tanks Program

Summary of Technical Information in the Application. LRA Section B.3.2 describes the existing Aboveground Steel Tanks Program as consistent with GALL AMP XI.M29, "Aboveground Steel Tanks." The applicant stated that the program includes preventive measures to mitigate corrosion and periodic inspections in order to manage the effects of loss of material due to corrosion on the exterior surface of aboveground steel tanks. The applicant also stated that the program uses the application of a qualified protective coating on the exterior surface of the condensate storage tank (CST) to mitigate corrosion due to environmental factors and the protective coating is visually inspected during existing coatings survey. The applicant further stated that inaccessible locations, such as tank bottoms, are periodically monitored for material degradation using ultrasonic thickness measurements from inside the tank.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated. The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M29. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M29, with the exception of the "monitoring and trending" and "acceptance criteria" program elements. For these program elements, the staff determined the need for additional clarification, which resulted in issuance of a request for additional information (RAI).

GALL AMP XI.M29 recommends tank bottom thickness measurements are to be evaluated under the "monitoring and trending" program element; however, during its audit, the staff could not determine whether the applicant's frequency of tank bottom thickness measurements would be sufficient to monitor the effects of corrosion on the tank bottom surface. The GALL AMP XI.M29 "acceptance criteria" program element recommends that visual inspections of tank coatings observe for degradation such as cracking, flaking, or peeling and tank bottom thickness measurements are to be evaluated against design thickness and corrosion allowances. However, during its audit, the staff could not determine if the LRA acceptance criteria are consistent because acceptance criteria were not provided in the LRA. By letter dated September 14, 2009, the staff issued RAI B.3.2-1 requesting that the applicant: (1) clarify how visual inspections are adequate to exclude corrosion of aboveground steel tank wall surfaces if no additional thickness measurements are made, (2) clarify and justify how the frequency of tank bottom thickness measurements, to be performed under the preventive maintenance program, are sufficient to detect and monitor the effects of corrosion on the tank bottom surfaces, and (3) clarify and justify how the acceptance criteria are determined.

In its response dated October 13, 2009, the applicant stated that: (1) the protective coating applied to the exterior surfaces of the CSTs will inhibit environmental factors from causing corrosion and subsequent loss of material of the tank shell. The applicant also stated that it will use visual inspections of the tank coating to determine the presence of aging effects and maintaining the coatings of the exterior surfaces precludes the need for additional thickness measurements of the tank walls; (2) periodic ultrasonic testing (UT) measurements on the in-scope tank bottoms have been performed, specifically in 1995, 1998, 2001, and 2009. The applicant also stated that the conclusion from the measurements is that no significant degradation or corrosion has occurred. The applicant further concluded that the frequency of the periodic inspection is acceptable based on plant-specific operational experience; and (3) thickness measurements from UT are reported to the Protective Coating Program owner, who evaluates the results against the tank bottom's design thickness and the corrosion allowance to determine acceptability. The applicant also stated that, although pitting corrosion was reported in the 1992 ultrasonic thickness measurements with a maximum pit depth of 0.080 inches, subsequent tank bottom measurements in 1995, 1998, 2001, and 2009 indicated no significant degradation had occurred. The applicant stated that the tank bottom average measured thickness was at or above the specified design nominal thickness of 0.3125 inches and the tanks have a corrosion allowance of 0.0625 inches.

The staff finds the applicant's response acceptable because of the applicant's commitment to use visual inspection and UT measurements for aging management with specific acceptance criteria. The staff's concern described in RAI B.3.2-1 is resolved.

Based on its audit and review of the applicant's response to RAI B.3.2-1, the staff finds that elements one through six of the applicant's Aboveground Steel Tanks Program are consistent with the corresponding program elements of GALL AMP XI.M29 and, therefore, acceptable.

Operating Experience. LRA Section B.3.2 summarizes operating experience related to the Aboveground Steel Tanks Program. The applicant stated that the program has been effective in managing the aging effects of corrosion and incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed in a way that these tanks will continue to perform their intended functions throughout the period of extended operation. The applicant discussed a 1988 example where a visual inspection detected faded paint and various rust spots on the exterior of two of the tanks in the program. Coating repairs were conducted and follow-up inspections in 1996, 2001, and 2007 through the Maintenance Rule Monitoring of Structures Program confirmed that the protective coating was in an acceptable condition, with no visible signs of significant coating degradation or surface corrosion on the exterior tank surface. The applicant discussed a second example where in 1992, ultrasonic thickness measurements of areas inaccessible to visual inspection were started. These were thickness measurements of the tank bottom for both CSTs, inclusive of sampling 64 random locations throughout the tank bottom, along with extensive grid-based measurements of three specific one-square foot locations that would be used for trending any material degradation over time. The applicant stated that these measurements revealed an average tank bottom thickness at or above the specified design thickness and that based on these measurements, it was concluded that no significant corrosion was taking place on the underside of the tank bottom. The applicant also stated that further inspections of both tanks in 1995 and 1998 confirmed this conclusion, with average ultrasonic thickness measurements at or above the design thickness.

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

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

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

UFSAR Supplement. LRA Section A.18.1.2 provides the UFSAR supplement for the Aboveground Steel Tanks Program. The staff reviewed this UFSAR supplemental description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Tables 3.3-2 and 3.4-2.

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

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

3.0.3.1.3 ASME Section XI Inservice Inspections, IWB, IWC, and IWD Program

Summary of Technical Information in the Application. LRA Section B.3.3 describes the existing ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program as consistent with GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD." The applicant stated that the program encompasses the requirements of ASME Code Section XI, Division 1, Subsections IWB, IWC, and IWD, 2001 Edition through the 2003 Addenda. The applicant also stated that, "Since DAEC has experienced cracking in ASME Code Class 1 piping, small-bore Class 1 piping in-scope for license renewal has been included in the ASME Section XI ISI [Inservice Inspection] Program."

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

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M1. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M1, with the exception of the "detection of aging effects" program element and the program description. For this element and the program description, the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

The applicant stated that it has relief requests submitted and approved by the staff, in accordance with 10 CFR 50.55a(a)(3) for its current 10-year ISI interval. The staff noted that the approved relief requests remain in effect until the end of the current interval, consistent with the approval, but does not automatically extend at the end of the interval. Furthermore, if the applicant seeks relief from specific requirements of Section XI of the ASME Code for the period of extended operation, the applicant must re-apply for relief, in accordance with 10 CFR 50.55(a).

The staff noted that 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 staff noted that the approval of the risk-informed methodology can not 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 staff noted that the "detection of aging effects" program element in GALL AMP XI.M1 states that the use of ASME Section XI Table IWB-2500-1 is used to determine the examination of category B-F and B-J welds. By letter dated September 14, 2009, the staff issued RAI B.3.3-1 requesting that the applicant clarify how the inspection of Categories B-F and B-J will be implemented during the period of extended operation.

In its response dated October 13, 2009, the applicant stated that during the period of extended operation, the inspection of categories B-F and B-J welds will be performed in accordance with 10 CFR 50.55(a) and ASME code requirements, unless approval has been received from the NRC for relief or use of alternatives.

Based on its review, the staff finds the applicant's response to RAI B.3.3-1 acceptable because the applicant will comply with the requirements of 10 CFR 50.55a for the period of extended operation and that this relief request does not extend to subsequent 10-year ISI intervals. The staff's concern described in RAI B.3.3-1 is resolved.

During its audit, the staff noted that since the applicant has already experienced cracking in its small-bore piping, according to GALL AMP XI.M35, a one-time inspection is no longer applicable and that a plant-specific program that consists of periodic inspections is appropriate to manage the aging effects and maintain the intended functions. The staff noted that the applicant has experienced significant cracking in its Class 1 piping in many code categories. By letter dated September 14, 2009, the staff issued RAI B.3.3-2 requesting that the applicant provide a plant-specific program to address the aging effects of stress corrosion cracking (SCC) and fatigue in Code Class 1 small-bore piping including socket welds.

In its response dated October 13, 2009, the applicant amended its LRA to include LRA Section B.3.40, ASME Code Class 1 Small-Bore Piping Inspection, which is a plant-specific program. The staff noted that the applicant amended LRA Section B.3.3 so that the inspections of small-bore piping are no longer associated with the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The staff reviewed the applicant's ASME Code Class 1 Small-Bore Piping Inspection Program and its evaluation is documented in SER Sections 3.0.3.3.3.

Based on its review, the staff finds the applicant's response to RAI B.3.3-2 acceptable because: (1) the applicant amended its LRA to include the new plant specific ASME Code Class 1 Small-Bore Piping Inspection Program, consistent with the recommendations of the GALL Report and (2) the applicant amended its LRA to remove the small-bore piping inspections from the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The staff's concern described in RAI B.3.3-2 is resolved.

Based on its audit and review of the applicant's response to RAI B.3.3-1 and B.3.3-2, the staff finds that elements one through six of the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program are consistent with the corresponding program elements of GALL AMP XI.M1 and, therefore, acceptable.

Operating Experience. LRA Section B.3.3 summarizes operating experience related to the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The applicant's review included its outage examination results during the third 10-year ISI interval and stated that its program activities have been performed satisfactorily.

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

During its review, the staff identified operating experience which could indicate that the applicant's program may not be effective in adequately managing aging effects during the period of extended operation. The staff determined the need for additional clarification, which resulted in the issuance of an RAI.

During its audit, the staff noted that the applicant did not provide an adequate plant-specific operating experience review. By letter dated September 14, 2009, the staff issued RAI B.3.3-3 requesting that the applicant provide plant-specific operating experience related to its ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The staff also requested the applicant provide operating experience related to its Code Class 1 small-bore piping.

In its response dated October 13, 2009, the applicant provided its ISI results from its RFO 18, RFO 19, RFO 20, and RFO 21. The staff noted that licensee event report (LER) (#2007-03-00) documented that the ISI inspection revealed unacceptable indications in its nozzle to safe-end weld during the June 2007 inspection. The staff noted that the nozzle was subsequently repaired by a weld overlay.

Based on its review, the staff finds the applicant's response to RAI B.3.3-3 acceptable because the applicant provided a more detailed operating experience review, provided specific examples of relevant operating experience for its program, and has taken appropriate corrective actions for flaw indications by performing repairs/replacements of the components. The staff's concern described in RAI B.3.3-3 is resolved.

Based on its audit, review of the LRA, and review of the applicant's response to RAI B.3.3-3, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program resulted in the applicant taking appropriate corrective actions. The staff confirmed that the “operating experience” program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

UFSAR Supplement. LRA Section 18.1.3 provides the UFSAR supplement for the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.1-2.

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

Conclusion. On the basis of its audit and review of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.4 ASME Section XI Inservice Inspection, Subsection IWE Program

Summary of Technical Information in the Application. LRA Section B.3.4 describes the existing ASME Section XI Inservice Inspection, Subsection IWE Program as consistent with GALL AMP XI.S1, “ASME Section XI, Subsection IWE.” The applicant stated that the program manages the aging effects of corrosion, physical displacements, loose or missing parts, debris, wear, erosion, or loss of integrity at bolted or welded connections. The components managed include the drywell, suppression chamber (torus), and the connecting piping, their supports and pressure retaining bolting. The applicant further stated that visual examinations specified in IWE are conducted to detect degradation, and limited volumetric and surface examinations may be necessary in some instances, depending on results of visual examinations.

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

The staff compared elements one through six of the applicant’s program to the corresponding elements of GALL AMP XI.S1. As discussed in the Audit Report, the staff confirmed that each element of the applicant’s program is consistent with the corresponding element of GALL AMP XI.S1, with the exception of the “monitoring and trending” program element. For this element, the staff determined the need for additional clarification, which resulted in the issuance of several RAIs.

By letter dated September 14, 2009, the staff issued RAI B.3.4-1 requesting that the applicant explain how the guidance in the program basis document regarding reexaminations of flawed areas is consistent with element 5 of GALL AMP XI.S1.

In its response dated October 13, 2009, the applicant explained that the program basis document and the LRA are consistent with the GALL Report, because they are consistent with the requirements of ASME Code Section XI, 2001 edition including the 2002 and 2003 Addenda as approved in 10 CFR 50.55a and endorsed in GALL AMP XI.S1. The staff reviewed the applicant’s response and determines that the wording in the program basis document matches the requirements of ASME Code Section XI, 2001 edition, which is the edition endorsed by the GALL Report. The staff noted that Chapter I of the GALL Report discusses the applicability of the ASME Code and states that except where noted, the staff has determined that the ASME Section XI, 2001 edition programs provide processes for identifying degradation that is attributable to applicable aging effects and are acceptable for managing the effects of aging. It further states, the staff indicates that certain parts of the code programs should be augmented to satisfy requirements for license renewal.

The staff determines that the requirements of the 2001 edition of the ASME Code Section XI are appropriate for the applicant’s program and do not require augmentation; the additional guidance in the “monitoring and trending” program element of GALL AMP XI.S1 is from an earlier code year which is superseded by the endorsed code (ASME Code Section XI 2001 edition).

Based on its review, the staff finds the applicant’s response to RAI B.3.4-1 acceptable because the applicant’s program is following the guidance of the appropriate code edition. The staff’s concern described in RAI B.3.4-1 is resolved.

By letter dated September 14, 2009, the staff issued RAI B.3.4-2 and RAI B.3.4-3 requesting that the applicant explain how relief requests MC-R001 and MC-P001, respectively, which discuss changes to the IWE required examinations, are consistent with the “monitoring and trending” program element of GALL AMP XI.S1.

In its response to RAI B.3.4-2 and RAI B.3.4-3 dated October 13, 2009, the applicant explained that both relief requests are effective through the second inspection interval, which ends with the current license period. The applicant further stated that during the period of extended operation, the inspection requirements for IWE will be followed, unless approval has been granted by the staff for relief or use of alternatives. The staff notes that the use of the relief requests MC-R001 and MC-P001 is appropriate for the current inspection interval, since the relief requests will not continue into the period of extended operation.

Based on its review, the staff finds the applicant’s response to RAI B.3.4-2 and RAI B.3.4-3 acceptable because the applicant’s program will follow the GALL Report guidance during the period of extended operation and during the period of extended operation the applicant will be following the inspection requirements for IWE. The staff’s concern described in RAI B.3.4-2 and RAI B.3.4-2 are resolved.

Based on its audit, and review of the applicant’s responses to RAIs B.3.4-1, B.3.4-2, and B.3.4-3, the staff finds that elements one through six of the applicant’s ASME Section XI Inservice Inspection, Subsection IWE Program, with acceptable exceptions, are consistent with the corresponding program elements of GALL AMP XI.S1 and, therefore, acceptable.

Operating Experience. LRA Section B.3.4 summarizes operating experience related to the ASME Section XI Inservice Inspection, Subsection IWE Program. In the LRA, the applicant stated that a review of the plant-specific operating experience found numerous instances of the program identifying degradation prior to loss of intended functions. The program has identified numerous areas of zinc (Zn) depletion of the torus coating and minor pitting and other indications. The applicant further stated that the corrosion rates were determined to be less than one thousandth inch per year, and all of these areas of concern were dispositioned in accordance with the appropriate requirements of IWE.

During its review, the staff identified operating experience which could indicate that the applicant's program may not be effective in adequately managing aging effects during the period of extended operation. The staff determined the need for additional clarification, which resulted in the issuance of RAIs.

By letter dated September 14, 2009, the staff issued RAI B.3.4-4 requesting that the applicant explain how records of degradations and repairs of the torus are maintained.

In its response dated October 13, 2009, the applicant explained that it maintains photographs, inspection reports and completed checklists, records of corrective actions, and other follow up information as quality assurance records. The applicant further stated that these records are available for review to support aging management during the period of extended operation. The applicant also explained that torus inspection procedures require a review of previously performed inspection results and requires documentation of current results, including observed suspect areas. Furthermore, the procedure specifies that the documentation should include photographs with noted deficiencies tracked by appropriate documentation to track resolution. The applicant further stated that examinations of submerged portions of the suppression chamber are performed by specialty contractors and the results and repairs are documented in the inspection report and procedure. Additionally, the applicant stated that initial and final inspections are videotaped and these tapes are available for review during subsequent inspections.

Based on its review, the staff finds the applicant's response to RAI B.3.4-4 acceptable because it demonstrates that the applicant maintains a record of torus degradations and repairs which can be reviewed during the period of extended operations.

By letter dated January 6, 2010, the staff issued RAI B.3.4-6 requesting that the applicant explain what actions were taken to address issues identified in Information Notice (IN) 92-20 and IN 2006-01. These INs discuss issues with Appendix J local leak rate testing and potential through-wall cracking of BWR Mark I containments, respectively.

In its response dated February 2, 2010, the applicant stated that IN 2006-01 discusses the occurrence of through-wall cracking in Fitzpatrick's torus due to cyclic stresses at the HPCI exhaust. These stresses are caused by condensation oscillation-induced fatigue. The applicant further stated that DAEC's HPCI exhaust line is not close to the torus ring girder gusset, and the steam exhaust is below the torus ring girder gusset elevation. Thus, the cyclic stresses in the area of the torus ring girder gusset caused by condensation oscillation loads during HPCI operations at DAEC are judged to be significantly less than at Fitzpatrick. In addition, visual inspections of this area have identified no evidence of fatigue cracking or through-wall leakage.

Regarding the problems involving local leak rate tests (LLRTs) described in IN 92-20, the applicant stated that DAEC has revised the Type B LLRT procedure for two ply expansion bellows. Testing performed in 2005 in accordance with revised procedure produced acceptable results.

The staff finds the applicant's response to RAI B.3.4-6 concerning the IN 2006-01 and IN 92-20 acceptable because the applicant has taken appropriate actions (as described above) in response to these INs.

In the LRA, the applicant stated that GALL AMP XI.S8, "Protective Coating Monitoring and Maintenance," is not applicable for aging management. By letter dated September 14, 2009, the staff issued RAI B.3.4-5 requesting that the applicant explain why the program does not apply. In addition, in RAI B.2.2 dated September 24, 2009, the staff requested that the applicant provide details on the Protective Coatings Monitoring and Maintenance 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).

In its response to RAIs B.3.4-5 and B.2.2, the applicant stated that DAEC does not credit coatings for the function of corrosion prevention; however, it implemented a coatings program in response to NRC Generic Letter (GL) 98-04. The applicant also stated that GALL AMP XI.S8 is not applicable as an AMP for DAEC because DAEC license renewal evaluations do not credit coatings for the function of preventing corrosion, but rather, the inspection and assessment of the condition of coatings inside containment and the torus are performed to minimize debris that could be generated during a loss-of-coolant accident (LOCA) to mitigate the potential for ECCS strainer clogging.

In its response to RAI B.2.2 and GL 98-04, the applicant provided the following. The scope of the coatings program at DAEC includes inspection of the interior and exterior surfaces of the suppression chamber (torus), vent lines, and downcomers, and the interior and accessible exterior surfaces of the drywell. These inspections are performed each refueling cycle. Visual inspection of the suppression chamber and drywell note any evidence of deterioration (e.g., discoloration, bubbling or flaking of the coating, corrosion, or pitting). The method of qualification testing and evaluation of the Service Level I coatings used for new applications or repair activities inside containment are performed in accordance with ANSI N101.2, "Protective Coatings (Paints) for Light Water Nuclear Reactor Containment Facilities." The inspectors are DAEC quality control personnel and ANSI N45.2.6 Certified Level II Visual Inspectors, who have been trained to perform ASME XI-IWE containment coatings inspections. A coating specialist or designee is required to perform a more detailed inspection of areas noted to have deficient coating as well as areas previously designated as requiring additional coating inspections, and determines if repair is necessary prior to power resumption from the outage. The coating specialist also reviews inspection results to determine if updates are required to the unqualified and degraded coatings log and evaluates whether the quantity of unqualified and degraded coatings is acceptable. Corrective actions are initiated as appropriate based on evaluations performed by the coating specialists.

The staff has reviewed the response to RAI B.2.2 and found the frequency of the inspection of the coatings in containment to be acceptable because inspecting every RFO would 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 ECCS. The scope of the program is also found to be acceptable because it includes coatings inside and outside the torus and drywell. Based on the types of deterioration that the DAEC coatings inspectors look for, and the evaluations performed by the coatings inspectors, the staff finds the acceptance criteria acceptable. The method of qualification testing and evaluation of the Service Level I coatings is acceptable since the staff has confirmed that the ANSI Standard

N101.2 is acceptable. The personnel who perform the inspection are found to be acceptable because they are qualified in accordance with relevant industry standards.

Therefore, the staff's concerns in RAIs B.2.2 and B.3.4-5 regarding the challenge to the ECCS due to the degradation of the protective coatings in containment is resolved. However, the staff requested additional information in RAI B.3.4-7 to resolve the staff concern about the degradation of torus due to corrosion.

By letter dated November 13, 2009, the staff issued RAI B.3.4-7 requesting the applicant to provide additional information about the number and extent of repairs performed on the torus to date. The staff also requested information on the applicant's future inspection plans and any plans to recoat the torus prior to or during the period of extended operation since according to DAEC Relief Request MC-R001, 4,229 repairs have been performed on the torus shell surface until 2005. The torus shell was initially coated in 1973 and recoated in 1985. Normal life of the torus coating is less than 20 years. At the start of the period of extended operation, it will be 29 years since the torus was recoated in 1985.

In its response to RAI B.3.4-7 dated December 14, 2009, the applicant stated that the torus coating has been repaired at 15,487 locations since 1995. However, only one pit had degradation that exceeded the maximum allowable pit depth of 0.053 inches (10 percent of 0.534 inch nominal shell thickness). That pit measured 0.056 inches in depth and 0.25 inches in diameter. The pit was dispositioned in the Corrective Action Program as acceptable without repair. The applicant further stated that the bottom half of the interior surface of the torus is accessible and is routinely inspected using divers. No UT exams are planned unless visual examination results indicate a need. The applicant further stated that the current plan has recoating of the torus scheduled in 2012. However, this schedule is dependent on the results of ongoing inspections.

Subsequent to the applicant's response to RAI B.3.4-7, the staff discussed DAEC's plans to recoat the interior surfaces of the torus in various telephone calls. To follow up these discussions, the applicant provided a new commitment (Commitment No.50), in a letter dated March 9, 2010, to completely recoat the torus (suppression pool) interior surface, below the water line, prior to startup from the first RFO during the period of extended operation. DAEC's period of extended operation starts on February 22, 2014.

In a conference call with the applicant on March 15, 2010, the staff requested additional information about the quantity/distribution of coating repairs above and below the water line and a brief description of the coating configuration on inside surface of the torus. In a letter dated April 2, 2010, the applicant stated all 15,487 repairs to the coating since 1995 have been made below the water line. This is equivalent to 5 percent of underwater coating surface inside the torus. Inspections performed by the applicant during recent outages have not identified any coating deficiencies that required repair above the water line. The applicant further stated that the current plan (Commitment 50) will ensure that the recoating will extend well above any fluctuations in water level, including the 2 feet wide splash band at water level. This splash band is currently coated with a modified phenolic paint while the rest of the torus interior surface is coated with a Zn primer.

Based on its review, the staff finds the applicant's response in RAI B.3.4-7 concerning repair and evaluation of coatings as acceptable because it demonstrate that the applicant is managing the torus coating in accordance with the ASME Code, Section XI, Subsection IWE requirements. However, the ASME Code does not address consideration of plant life extension or determination of when a coating should be replaced. The applicant's Commitment No. 50 to recoat the torus interior surface below water line will provide corrosion protection to the exposed bare steel substrate and localized coating failures. Recoating of the torus below the water line will also minimize the potential of a through wall pit which would impact containment integrity. Pitting corrosion rates are typically much higher and less predictable than general corrosion rates. Based on the applicant's operating experience, coating on the torus interior surface above the water line does not appear to be degraded and will be managed for as a part of containment inservice inspection program.

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

<u>UFSAR Supplement</u>. LRA Section A.18.1.4 provides the UFSAR supplement for the ASME Section XI Inservice Inspection, Subsection IWE Program. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.5-2.

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

<u>Conclusion</u>. On the basis of its review of the applicant's ASME Section XI Inservice Inspection, Subsection IWE Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.5 ASME Section XI Inservice Inspection, Subsection IWF Program

<u>Summary of Technical Information in the Application</u>. LRA Section B.3.5 describes the existing ASME Section XI Inservice Inspection, Subsection IWF Program as consistent with GALL AMP XI.S3, "ASME Section XI, Subsection IWF." The applicant stated that the program manages the aging effects of corrosion, physical displacements, loose or missing parts, debris, wear, erosion, or loss of integrity at bolted or welded connections. Class 1, 2, and 3 piping and component supports are included in the program. The applicant further stated that visual testing (VT)-3 examinations are conducted to detect degradation. The applicant stated that the inspections would verify parameters such as clearances, settings, and physical displacement, and would detect discontinuities and imperfections, such as loss of integrity of bolted or welded connections, loose or missing parts, debris, corrosion, wear, or erosion.

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

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.S3. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.S3. Based on its audit, the staff finds that elements one through six of the applicant's ASME Section XI Inservice Inspection, Subsection IWF Program are consistent with the corresponding program elements of GALL AMP XI.S3 and, therefore, acceptable.

Operating Experience. LRA Section B.3.5 summarizes operating experience related to the ASME Section XI Inservice Inspection, Subsection IWF Program. In the LRA, the applicant stated that a review of the plant-specific operating experience found instances of selected supports being removed during outages prior to receiving an inspection. The applicant explained this was more of a work control failure than a failure of the ASME Section XI Inservice Inspection, Subsection IWF Program. The applicant also described a document review associated with closeout activities of the ASME Section XI Inservice Inspection Program third period 10-year interval. One administrative issue was identified regarding an incorrect reference to the applicable weld examination; however, the evaluation concluded that the Inservice Inspection Program activities had been satisfactorily performed.

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

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

The staff reviewed the administrative and work control issues discussed in the application and found them to be minor in nature. Since the applicant took appropriate action to identify and correct the issues prior to the period of extended operation, the staff finds that there is reasonable assurance the ASME Section XI Inservice Inspection, Subsection IWF Program will be implemented effectively during the period of extended operation.

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

UFSAR Supplement. LRA Section A.18.1.5 provides the UFSAR supplement for the ASME Section XI Inservice Inspection, Subsection IWF Program. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.5-2.

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

Conclusion. On the basis of its audit and review of the applicant's ASME Section XI Inservice Inspection, Subsection IWF Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.6 Bolting Integrity Program

Summary of Technical Information in the Application. LRA Section B.3.6 describes the existing Bolting Integrity Program as consistent with GALL AMP XI.M18, “Bolting Integrity.” The applicant stated that the Bolting Integrity Program manages the aging effects of loss of preload, cracking, and loss of material. The applicant also stated that the program includes guidance regarding material selection, thread lubrication, and assembly of bolted joints. The applicant further stated that the program considers the guidelines in NUREG-1339, “Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants,” Electric Power Research Institute (EPRI)-NP-5769, “Degradation and Failure of Bolting in Nuclear Power Plants,” (with the exceptions noted in NUREG-1339) for safety-related bolting; and EPRI TR-104213, “Bolted Joint Maintenance and Application Guide,” for nonsafety-related bolting.

Staff Evaluation. During its audit, the staff confirmed the applicant’s claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated. The staff compared elements one through six of the applicant’s program to the corresponding elements of GALL AMP XI.M18. As discussed in the Audit Report, the staff confirmed that each element of the applicant’s program is consistent with the corresponding element of GALL AMP XI.M18, with the exceptions of the “scope of the program,” “parameters monitored or inspected,” and “detection of aging effects” program elements. For these elements, the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

The staff reviewed the applicant’s program basis document and noted a discrepancy in the applicant’s list of other AMPs that perform inspection activities credited in the program. The program basis document lists five AMPs that perform bolting inspections: (1) the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program; (2) the ASME Section XI Inservice Inspection, Subsection IWF Program; (3) the External Surfaces Monitoring Program; (4) the Structures Monitoring Program; and (5) the Buried Piping and Tanks Inspection Program; however, LRA Section B.3.6 and the UFSAR supplement Section A.18.1.6 list only four credited AMPs, with the Buried Piping and Tanks Inspection Program being omitted in each instance. By letter dated September 14, 2009, the staff issued RAI-B.3.6-01 requesting the applicant to resolve the documentation discrepancy described above.

In its response dated October 13, 2009, the applicant revised LRA Sections A.18.1.6 and B.3.6.1 to correctly list all five of the credited AMPs. The staff finds the applicant’s revisions to the LRA to be acceptable because the changes resolve the documentation discrepancy noted by the staff. The staff’s concern described in RAI-B.3.6-01 is resolved.

The staff reviewed the applicant’s program basis document and noted that more detail was required in regard to the “parameters monitored or inspected” and the “detection of aging effects” program elements to include inspection of fasteners, bolting, washers, and nuts as a specific activity in each of the five credited AMPs. By letter dated September 14, 2009, the staff issued RAI B.3.6-02 requesting the applicant to provide: (1) a commitment to include inspection of fasteners, bolting, washers, and nuts as a specific activity in each of the five credited AMPs and (2) technical justification that bolting inspections performed under the other credited AMPs are equivalent to the bolting inspections recommended by GALL AMP XI.M18.

In its response dated October 13, 2009, the applicant revised LRA Appendix A, Section 18.4, Table A-1 to add new Commitment No. 41, related to the Bolting Integrity Program, which is to be implemented prior to the period of extended operation. In the new commitment, the applicant stated that it will revise the implementing procedures for the ASME Section XI Inservice Inspection Subsections IWB, IWC, and IWD Program; ASME Section XI Inservice Inspection, IWF Program; External Surfaces Monitoring Program; Structural Monitoring Program; and Buried Piping and Tanks Inspection Program such that they will specifically address the inspection of fasteners (bolting, washers, nuts, etc.) for signs of leakage, corrosion/loss of material, cracking, and loss of preload/loss of prestress, as applicable. The applicant also stated that the wording of new Commitment No. 41 is equivalent to wording in GALL AMP XI.M18, program elements "parameters monitored or inspected," and "detection of aging effects."

The staff finds the response acceptable because the applicant's new Commitment No. 41 fulfills the staff's request that the applicant provide a commitment to include inspection of fasteners, bolting, washers, and nuts in each of the AMPs credited by the Bolting Integrity Program. In addition, the staff compared the wording of the applicant's Commitment No. 41 with the recommendations in GALL AMP XI.M18, program elements "parameters monitored or inspected," and "detection of aging effects," and determined that Commitment No. 41 includes sufficient detail to ensure that the bolting inspections provided by the credited AMPs are equivalent to the inspections recommended in GALL AMP XI.M18. The staff's concern described in RAI-B.3.6-02 is resolved.

The staff reviewed the applicant's program basis document and noted that it had insufficient information to determine which AMP is credited for inspection of bolting in a raw water environment. By letter dated September 14, 2009, the staff issued RAI B.3.6-03, requesting that the applicant: (1) identify the AMPs that are credited with performing inspection of carbon steel and stainless fasteners, bolting, washers, and nuts in a raw water environment and (2) provide justification that the inspection of fasteners, bolting, washers, and nuts performed under the identified AMP(s) is equivalent to the inspection of fasteners, bolting, washers, and nuts recommended for these components in GALL AMP XI.M18.

In its response dated October 13, 2009, the applicant stated that for the emergency service water system (ASME Class 3) and the residual heat removal service water system (ASME Class 3), the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program performs inspection of fasteners, bolting, washers, and nuts that are in a raw water environment. The applicant further stated that for the fire protection system, the river water supply system, and the intake and traveling screens, the External Surfaces Monitoring Program performs the inspection of fasteners, bolting, washers, and nuts that are in a raw water environment. The applicant's response also provided a comparison of the bolting inspections performed under the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD and the External Surfaces Monitoring programs with the bolting inspection recommendations in GALL AMP XI.M18.

The staff finds the response acceptable because it provides the requested clarification with regard to which programs are credited for inspection of bolting in a raw water environment. In addition, the staff reviewed the applicant's comparison of bolting inspection requirements in the

ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD and the External Surfaces Monitoring programs against recommendations in GALL AMP XI.M18 and noted that the bolting inspections in the two credited AMPs discussed by the applicant are consistent with the bolting inspections recommended in GALL AMP XI.M18. The staff's concern described in RAI B.3.6-03 is resolved.

Based on its audit and review of the applicant's responses to RAIs B.3.6-01, B.3.6-02, and B.3.6-03, the staff finds that program elements one through six of the applicant's Bolting Integrity Program are consistent with the corresponding program elements of GALL AMP XI.M18 and, therefore, acceptable.

Operating Experience. LRA Section B.3.6 summarizes operating experience related to the Bolting Integrity Program. The applicant stated that the Bolting Integrity Program has been effective in managing the aging effects of loss of preload, cracking, and loss of material in fasteners, bolting, washers, and nuts. The applicant also stated that the program incorporates both industry and plant-specific operating experience to ensure that the aging effects are adequately managed for these components. The applicant further stated that one bolting issue, documented and corrected within the corrective action program, was determined to be a design issue related to failure to provide correct bolt torques for proper preload. The applicant also stated that site self-assessment activities have not identified any programmatic issues with the Bolting Integrity Program.

The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program. During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation.

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

UFSAR Supplement. LRA Section A.18.1.6 provides the UFSAR supplement for the Bolting Integrity Program. The staff reviewed this UFSAR supplement description of the program against the recommended description for this type of program as described in SRP-LR Table(s) 3.1-2, 3.2-2, 3.3-2, 3.4-2, and 3.5-2. As discussed in RAI B.3.6-01, above, the staff reviewed the applicant's UFSAR supplement and found a documentation discrepancy between the program description in LRA Section A.18.1.6 and the applicant's program basis document for the program. By letter dated September 14, 2009, the staff issued RAI B 3.6-01 requesting that the applicant resolve this discrepancy.

In its response dated October 13, 2009, the applicant stated that it had corrected the discrepancy, as discussed above. The staff finds the applicant's revisions to the LRA to be acceptable because the changes resolve the documentation discrepancy noted by the staff.

The staff also notes that the applicant committed (Commitment No. 41) to revise the implementing procedures for the ASME Section XI Inservice Inspection Subsections IWB, IWC, and IWD Program; ASME Section XI Inservice Inspection, IWF Program; External Surfaces Monitoring Program; Structural Monitoring Program; and Buried Piping and Tanks Inspection Program such that they specifically address the inspection of fasteners (bolting, washers, nuts, etc.) for signs of leakage, corrosion/loss of material, cracking, and loss of preload/loss of prestress, as applicable, prior to entering the period of extended operation for managing aging of applicable components.

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

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

3.0.3.1.7 Buried Piping and Tanks Inspection Program

Summary of Technical Information in the Application. LRA Section B.3.7 describes the new Buried Piping and Tanks Inspection Program as consistent with GALL AMP XI.M34 "Buried Piping and Tanks Inspection." The applicant stated that the program addresses loss of material due to general corrosion, pitting, crevice and microbiological-induced corrosion of buried carbon, low alloy and stainless steel piping and tanks. The applicant also stated that it will manage aging through visual inspections of the protective wraps and coatings on the piping or tank during opportunistic or focused inspections.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated. The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M34. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M34, with the exception of the "scope of the program," "preventive actions," "detection of aging effects," and "acceptance criteria" program elements. For these elements, the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

The program description of GALL AMP XI.M34 states that the scope of the AMP includes buried steel piping and tanks. The term "steel" includes carbon steel, low alloy steel, and cast iron, but does not include stainless steel. The applicant stated that the scope of the program includes carbon steel, low alloy steel, and stainless steel. Additionally, the scope of the LRA AMP does not appear to include cast iron although cast iron components are present in systems addressed by this AMP. By letter dated September 14, 2009, the staff issued RAI B.3.7-1 requesting that the applicant commit to revise the LRA AMP to show the inclusion of stainless steel buried piping as an exception, justify why the proposed program is sufficient to manage the aging of stainless steel pipe, and to modify the scope of the LRA AMP to specifically include cast iron.

In its response dated October 13, 2009, the applicant revised the AMP as requested by the staff, justified why the proposed program is sufficient to manage the aging of stainless steel pipe, and specifically included cast iron in the scope of the AMP. The revised AMP states that the presence of buried, uncoated cast iron and stainless steel pipe is an exception to the GALL AMP. In its justification of the adequacy of its buried piping program, the applicant stated that uncoated buried stainless steel and cast iron piping is inspected in accordance with the GALL AMP.

The staff finds the applicant's response acceptable because it correctly shows the inclusion of uncoated stainless steel and cast iron piping as exceptions to the GALL AMP and because the inspections performed by the proposed AMP are appropriate for the management of corrosion of stainless steel and cast iron buried piping. The staff's concern described in RAI B.3.7-1 is resolved.

GALL AMP XI.M34 recommends use of coated pipe under the "preventive actions" program element description; however, during its audit the staff found that it is not clear that the applicant's cast iron pipes are coated. Elsewhere in the program it is stated that stainless steel pipes are not coated. By letter dated September 14, 2009, the staff issued RAI B.3.7-2 requesting that the applicant clarify whether buried cast iron pipes are coated; commit to revise the LRA AMP to show the inclusion of uncoated buried piping as an exception; and justify why the proposed program is sufficient to manage the aging of uncoated stainless steel and/or cast iron pipes.

In its response dated October 13, 2009, the applicant referred the staff to its response to RAI B.3.7-1. The applicant further stated that buried uncoated stainless steel and cast iron pipe will be inspected for loss of material due to pitting and crevice corrosion, and microbiologically-induced corrosion (MIC). As described above, the applicant's response to RAI B.3.7-1 contains satisfactory answers to all aspects of this RAI.

The staff finds the applicant's response acceptable because buried uncoated cast iron piping is allowed by NFPA and the applicant has appropriately identified the applicable aging effects for buried uncoated stainless steel and cast iron piping. The staff's concern described in RAI B.3.7-2 is resolved.

SRP-LR Section A.1.2.3.4 states that the program element "detection of aging effects" should contain information concerning the frequency, extent, sample size and methods used to detect aging. The staff notes that much of this information is absent from this section of the LRA AMP. In order for the staff to evaluate the consistency of this LRA program element with the corresponding GALL Report program element, it is necessary that the applicant provide additional information concerning the program for detection of aging effects. By letter dated September 14, 2009, the staff issued RAI B.3.7-3 requesting that the applicant provide additional details of the proposed inspection program.

In its response dated October 13, 2009, the applicant stated that:

> Buried uncoated cast iron and stainless steel pipes will be visually inspected for loss of material. In-scope buried piping and tanks at DAEC will have an opportunistic inspection whenever they are excavated for any reason. The inspections are performed in areas with the highest likelihood of corrosion problems based on plant operating experience, within the areas made accessible to support the maintenance activity. The length of pipe included in the inspection

> will be based on multiple factors. The excavation site will be in compliance with DAEC safety procedures which invoke OSHA requirements for Trenching and Excavation Safety. Compliance with the safety requirements will ensure that an adequate length of pipe will be exposed to perform the inspection. Additionally the excavation will be of sufficient depth to allow for examination underneath the pipe.

The staff finds this response acceptable because within the program description the applicant is consistent with the GALL AMP in regard to conducting one excavated visual buried pipe inspection in both the ten-year period prior to extended operation and in the first ten-year period of extended operation. Further, the staff acknowledges that OSHA procedures for excavation require safety equipment, such as cave-in protection, and that the use of such equipment requires the excavation of many feet of piping which constitutes a suitable representative sample for the purpose of corrosion analysis. The staff's concern described in RAI B.3.7-3 is resolved.

SRP-LR Section A.1.2.3.6 states that the program element "acceptance criteria" should contain information concerning the acceptance criteria against which the need for corrective action will be measured. The staff notes that this information is absent from this section of the program. By letter dated September 14, 2009, the staff issued RAI B.3.7-4 requesting that the applicant provide acceptance criteria as indicated in the SRP-LR.

In its response dated October 13, 2009, the applicant stated that coating and wrapping degradation, or components identified with significant corrosion, will be documented and evaluated under the corrective action program, which includes provisions for a root cause analysis, if appropriate. The applicant also stated that evaluations performed as part of the corrective action program may include use of applicable acceptance criteria of existing plant procedures such as the "Corrosion Monitoring Program Manual" and the "Fire Protection Monitoring Program."

The staff notes that the use of the corrective action program and, as necessary, root cause analyses is recommended by the GALL AMP. The staff also notes that the applicant uses established guidance procedures/documents against which to judge the need for corrective action, as recommended by SRP-LR Section A.1.2.3.6. The staff finds this response acceptable because the acceptance criteria is contained within plant procedures. The staff's concern described in RAI B.3.7-4 is resolved.

The staff also reviewed the portions of the "scope of the program" program element associated with the below exception to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this exception follows.

Exception. LRA Section B.3.7, as amended by letter dated October 13, 2009, states an exception to the "scope of the program" program element. The exception, as discussed in RAI B3.7-1, expands the program's scope to include buried stainless steel piping. The staff finds the exception acceptable because the inspections performed by the proposed AMP are appropriate for the management of corrosion of uncoated stainless steel and cast iron buried piping.

Based on its audit and review of the applicant's response to RAI B.3.7-1, B.3.7-2, B.3.7-3, and B.3.7-4, the staff finds that elements one through six of the applicant's Buried Piping and Tanks

Inspection Program, with acceptable exception, are consistent with the corresponding program elements of GALL AMP XI.M34 and are, therefore, acceptable.

Operating Experience. LRA Section B.3.7 summarizes operating experience related to the Buried Piping and Tanks Inspection Program. The applicant stated that the program is new and, therefore, there has been no plant-specific program operating experience. The applicant also stated that industry operating experience will be evaluated in the development and implementation of this program and, as additional operating experience is obtained, lessons learned will be appropriately incorporated into the program.

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

During its review, the staff identified operating experience which could indicate that the applicant's program may not be effective in adequately managing aging effects during the period of extended operation. The staff determined the need for additional clarification, which resulted in the issuance of an RAI. 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. By letter dated May 3, 2010, the staff issued RAI B.3.7-1-X requesting that the applicant provide information regarding how it will incorporate the recent industry OE into its aging management reviews and programs.

In its response dated May 28, 2010 and supplemented on July 29, 2010, and August 18, 2010, the applicant stated that it had one leak in buried in-scope piping, this being in a portion of fire protection piping constructed of ductile cast iron and the cause for the leak on this uncoated and non-cathodically-protected line was external pitting. The applicant also stated it has conducted ten opportunistic inspections in other portions of the fire protection piping and found the piping to be in good condition. The applicant further stated that (1) in 1994 all the cathodic protection anodes which protect all the buried carbon and stainless steel piping were replaced, the station commenced periodic checks on all rectifiers, periodic NACE qualified surveys have been conducted since 2003 and annual surveys will be conducted in the period of extended operation, and the cathodic protection system will be available 90% of the time, (2) all carbon steel piping is coated in accordance with appropriate industry standards, (3) during inspections of buried piping and conduct of fifteen test holes to obtain soil samples, the backfill has been found to be sand with no rocks, (4) it has committed to conduct excavated visual inspections of at least ten linear feet of buried pipe in each material group, including one for stainless steel, two for carbon steel, one for cast iron, and two for ductile iron prior to entry into the period of extended operation and each ten-year period after entry into the period of extended operation, (5) at least one of the carbon steel piping inspections will include the diesel fuel oil piping prior to entry into the period of extended operation and piping that normally contains hazardous materials will be prioritized in the inspection location selection process, and (6) it has committed to perform an internal inspection of the buried concrete in-scope piping, inspecting for cracking, spalling and loss of bond. The applicant stated that internal inspections of the concrete piping will be performed instead of excavations due to potential for damage to the concrete during excavations.

The LRA states that the high pressure core injection, condensate and demineralizer, emergency service water, residual heat removal service water, river water, diesel generator fuel oil, and fire protection systems have buried piping. Based on a review of plant-specific OE, the staff notes that there has been one failure of in-scope buried piping. The staff also notes that this is a recent failure, and the applicant has enhanced its buried pipe program with additional inspections to ensure that the extent of condition has been identified. The staff finds the applicant's response acceptable because (1) cathodic protection will be available at least 90% of the time, with periodic checks on all rectifiers and annual NACE-qualified surveys, (2) all carbon steel piping is coated in accordance with appropriate industry standards, (3) backfill consists of sand with no rocks as found during multiple inspections, (4) excavated visual inspections of at least ten linear feet of buried pipe in each material group will be conducted, including one for stainless steel, two for carbon steel, one for cast iron, and two for ductile iron prior to entry into the period of extended operation and each ten-year period after entry into the period of extended operation, (5) at least one of the carbon steel piping inspections will include the diesel fuel oil piping prior to entry into the period of extended operation and during the period of extended operation, the applicant's risk ranking for selecting the specific piping segments to be inspected will recognize that piping which normally contains hazardous materials has a higher priority due to the consequences of a leak, and (6) internal inspections of the buried concrete in-scope piping, inspecting for cracking, spalling and loss of bond will be conducted. The staff notes that it is possible to excavate buried concrete piping without damaging the pipe; however, the staff finds the applicant's recommendation acceptable because the operating pressure of the system is low, the piping segments do not contain hazardous material or radioactive water and the visual inspections from the inside of the pipe can detect cracking prior to the licensing basis function being challenged.

Based on its audit and review of the application, and review of the applicant's responses to RAI B.3.7-1-X, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

<u>UFSAR Supplement</u>. LRA Section A.18.1.7 provides the UFSAR Supplement for the Buried Piping and Tanks Inspection Program. The staff reviewed this UFSAR supplement description of the program against the recommended description for this type of program as described in SRP-LR Tables 3.2-2, 3.3-2, and 3.4-2.

The staff reviewed the applicant's commitment for the program. In that review, the staff noted that the applicant used the term "develop" to describe the action to be taken prior to the period of extended operation instead of "implement." Given the possibility that a program could be developed and not implemented, it is not clear to the staff that the wording used by the applicant is consistent with the wording used in the SRP-LR. By letter dated September 14, 2009, the staff issued the new program commitments RAI to request that the applicant modify the commitments for new programs so that the commitment clearly states that the program will be implemented prior to the period of extended operation.

In its response dated October 13, 2009, the applicant modified its commitments for this program to use language consistent with the language used in the SRP-LR. The applicant also added a footnote to LRA Table A-1 related to license renewal commitments, stating, "In the table, the term 'implement' means that the program is described in an approved procedure or other approved formal document; the test, inspection, or monitoring procedure has been developed and approved; and the first test, inspection, or monitoring activity has been scheduled."

The staff finds this response acceptable because the language used by the applicant clearly states the applicant's intent to implement the program prior to the period of extended operation.

The staff also notes that the applicant committed (Commitment No. 1) to implement the new Buried Piping and Tanks Inspection Program prior to entering the period of extended operation for managing aging of applicable components. The staff further notes that the applicant committed (Commitment Nos. 52 and 53) to (1) provide cathodic protection at least 90% of the time, and conduct annual NACE surveys, (2) conduct excavated visual inspections of at least ten linear feet of buried pipe in each material group, including one for stainless steel, two for carbon steel, one for cast iron, and two for ductile iron prior to entry into the period of extended operation and each ten year period after entry into the period of extended operation, (3) include the diesel fuel oil piping as at least one of the carbon steel piping inspections prior to entry into the period of extended operation, and (4) prioritize piping that normally contains hazardous materials in the inspection location selection process.

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

Conclusion. On the basis of its audit and review of the applicant's Buried Piping and Tanks Inspection Program, the staff determines that the program elements are consistent with the GALL Report including an exception for the "scope of program" program element. 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 the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.8 BWR Control Rod Drive Return Line Nozzle Program

Summary of Technical Information in the Application. LRA Section B.3.8 describes the existing BWR CRD Return Line Nozzle Program as consistent with GALL AMP XI.M6, "BWR Control Rod Drive Return Line Nozzle." The applicant stated that the BWR CRD Return Line Nozzle Program ensures that cracks in the CRD return line nozzle due to thermal stresses will be detected prior to loss of its intended function. The applicant stated that the program also ensures that cracks in the CRD return line pipe containing stagnant water that is susceptible to intergranular stress corrosion cracking (IGSCC) will be detected prior to loss of its intended function. The applicant stated that the program consists of physical plant modifications and inspections as recommended by NUREG-0619, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking," and ASME Code Section XI.

The applicant stated that it has taken actions to eliminate thermal cycling by removing the CRD return line thermal sleeve and installing a blind flange (spectacle) to prevent flow through the CRD return line nozzle during plant operation. The applicant stated that the blind flange is physically located on the outboard side of the second containment isolation valve in the CRD return line pipe and that the inspection volume described in the program extends only to the second containment isolation valve. The applicant stated that it complies with applicable requirements of ASME Code Section XI by performing periodic ultrasonic inspections of critical regions of the CRD return line nozzle. The applicant stated that it inspects the welds in the CRD return line stainless steel pipe section that contains stagnant water and is susceptible to IGSCC, and that the stainless steel pipe section runs from the nozzle safe-end to a reducer in the CRD return line piping. The applicant further stated that the Class 1 CRD return line pipe, from the reducer to the second containment isolation valve, is carbon steel, which is not susceptible to IGSCC and is not included in the BWR CRD Return Line Nozzle Program. Additionally, the applicant stated that aging of the carbon steel and stainless steel pipe from the CRD return line nozzle to the second containment isolation valve is also managed for loss of material by the Water Chemistry Program and the One-Time Inspection Program.

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

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M6. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M6, with the exception of the "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program elements. For these elements, the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

During its audit, the staff reviewed the applicant's program basis document which states that its program includes: (1) system modifications to eliminate thermal cycling of the CRD return line nozzle, (2) ISI of the CRD return line nozzle, as required by ASME Code Section XI, Subsection IWB, Table IWB-2500-1, Examination Category B-D (Full Penetration Welded Nozzles in Vessels), and (3) augmented ISI, as required by NUREG-0619, Revision 1. The staff finds these features of the applicant's program to be consistent with recommendations of the GALL Report and, therefore, acceptable.

The staff noted in the "preventive actions" program element of the applicant's program and the system modifications implemented in response to NUREG-0619, that the applicant's systems modifications appear to be functionally equivalent to modification options described in NUREG-0619. However, the staff also noted that the applicant's modifications are implemented in a way that is different from any option described in NUREG-0619 or in GALL AMP XI.M6. By letter dated September 14, 2009, the staff issued RAI B.3.8-1 requesting the applicant to explain why its CRD return line modifications are not identified as an exception to the "preventive actions" program element described in GALL AMP XI.M6.

In its response dated October 13, 2009, the applicant stated that the mitigation option selected for the CRD return line was to install a blind flange in the line rather than to permanently cut and cap the line as described in the "preventive actions" program element in GALL AMP XI.M6. The applicant stated that this mitigation strategy was specifically approved by the staff in a letter dated December 8, 1981. The applicant further stated that because GALL AMP XI.M6 does not explicitly mention blind flanging as a mitigation option, blocking the CRD return line with a blind flange can be viewed as an exception to the GALL Report. Accordingly, the applicant amended its LRA to state that the method for blocking the CRD return line uses a blind flange instead of cutting and capping the line and that this is an exception to the "preventive actions" program element described in GALL AMP XI.M6.

Based on its review, the staff finds the applicant's response to RAI B.3.8-1 acceptable because the applicant amended its LRA to identify an exception to the "preventive actions" program element. The staff's review of this newly identified exception and its acceptability is discussed below. The staff's concern described in RAI B.3.8-1 is resolved.

The staff reviewed the applicant's augmented ISI program for the CRD return line against requirements described in NUREG-0619, and noted a difference between the applicant's current augmented ISI schedule and the augmented examination schedule described in NUREG-0619. Specifically, NUREG-0619, Section 8.2, item (3) states that during each RFO, the portion of the CRD return line containing stagnant water and susceptible to IGSCC (i.e., not made of carbon steel) must be inspected in accordance with the recommendations of NUREG-0313, Revision 1, "Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping." However, the staff noted that the applicant's current augmented ISI program requires examination of the stainless steel portion of the CRD return line that contains stagnant water on a frequency of once every third RFO, rather than at every RFO. By letter dated September 14, 2009, the staff issued RAI B.3.8-2 requesting that the applicant justify that examination every third RFO is adequate, and to explain why this examination schedule is not identified as an exception to the recommendations in the "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program elements of GALL AMP XI.M6.

In its response dated October 13, 2009, the applicant amended its LRA to add an exception to its program to state that the inspection frequency is based on ASME Code Section XI rather than NUREG-0619 as specified in GALL AMP XI.M6. The applicant stated that this exception affects the "parameters monitored or inspected," the "detection of aging effects," and the "monitoring and trending" program elements.

Based on its review, the staff finds the applicant's response to RAI B.3.8-2 acceptable, because the applicant amended its LRA to identify an exception to the "parameters monitored or inspected," the "detection of aging effects," and the "monitoring and trending" program elements. The staff's review of this newly identified exception and its acceptability is discussed below. The staff's concern described in RAI B.3.8-2 is resolved.

The staff also reviewed the portions of the "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program elements associated with the exceptions, as amended by letter dated October 13, 2009, to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these exceptions follows.

<u>*Exception 1*</u>. LRA Section B.3.8 states an exception to the "preventive actions" program element, as amended by letter dated October 13, 2009. The applicant stated it proposed a schedule and modifications to meet the requirements of NUREG-0619 in letters to the staff dated February 4, 1981 and October 26, 1981. The applicant further stated that these letters describe the modification planned to stop CRD flow by using a blind flange in lieu of a cut and cap method. The applicant stated that the NRC approved this approach in a letter dated December 8, 1981 and that the approach taken is a fully acceptable alternative that is equivalent to cutting and capping the line.

The staff reviewed the applicant's response to RAI B.3.8-1, in a letter dated October 13, 2009, and determines that the applicant uses a method for blocking CRD return line flow to the reactor vessel that is functionally equivalent to the methods described in GALL AMP XI.M6 and in

NUREG-0619. The staff also determined that the applicant's method has been specifically approved by the staff and is included in the applicant's CLB. The staff finds that the preventive actions associated with the applicant's method for blocking CRD return line flow provide the same mitigating effects as those explicitly described in GALL AMP XI.M6.

Based on its review, the staff finds this exception is acceptable because the applicant's configuration for the CRD return line provides preventive actions equivalent to what is described in the GALL AMP XI.M6 and is included in the applicant's CLB.

Exception 2. LRA Section B.3.8 states an exception to the "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program elements, as amended by letter dated October 13, 2009. The applicant stated its inspection frequency is based on the ASME Code requirements implemented under 10 CFR 50.55a. The applicant stated that the inspection requirements in its program provide a fully acceptable schedule of inspections commensurate with the NRC endorsed requirements of ASME Code Section XI.

In its response to RAI B.3.8-2, dated October 13, 2009, the applicant stated that, as currently implemented, the CRD return line piping containing stagnant water is required to be ultrasonically examined in accordance with the following criteria:

(1) Every RFO; or

(2) If (1) above finds the welds free of unacceptable indications for three successive examinations, the examination frequency may be extended to each 36-month period (plus or minus by as much as 12 months) coinciding with a RFO. This is defined as every other outage; or

(3) If (2) above finds the welds free of unacceptable indications for three successive examinations, the frequency of examination may revert to 80-month periods (two-thirds the time prescribed in ASME Code Section XI). This is defined as every third RFO.

The staff reviewed the applicant's response to RAI B.3.8-2, in a letter dated October 13, 2009, and its justification and noted that the applicant's CRD return line examination frequency is conservative when compared with ASME Code Section XI requirements, which require examination at least once during each 10-year inspection interval. The staff further noted that the applicant's original CRD return line inspection frequency was aligned with recommendations in NUREG-0619, and that adjustments to that original frequency have been made based on successful plant-specific inspection results confirming that there are no new indications of IGSCC in the susceptible portion of CRD return line piping containing stagnant water.

Based on its review, the staff finds this exception is acceptable because the applicant's current schedule for inspection of the CRD return line stagnant water piping is on a frequency based on plant-specific results that are sufficient to detect indications of IGSCC before loss of the pressure boundary function of the CRD return line piping.

Based on its audit, and review of the applicant's responses to RAI B.3.8-1 and RAI B.3.8-2, the staff finds that elements one through six of the applicant's BWR CRD Return Line Nozzle Program, with acceptable exceptions, are consistent with the corresponding program elements of GALL AMP XI.M6 and, therefore, acceptable.

Operating Experience. LRA Section B.3.8 summarizes operating experience related to the BWR CRD Return Line Nozzle Program. The applicant stated its program has been effective in managing the aging effects of cracking. The applicant also stated that the most recent scheduled inspection of the CRD return line stagnant water pipe welds was performed during RFO 18 (Spring 2003) and that no indications were found in the welds. In addition, the applicant described results of its ISI program assessments that have concluded the applicant's ISI program activities have been satisfactorily performed.

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

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

Based on its review, the staff finds: (1) that the operating experience related to this AMP demonstrates that the applicant's BWR CRD Return Line Nozzle Program achieves its objective of mitigating and preventing cracking in the CRD return line nozzle and associated piping, and (2) that the applicant takes appropriate corrective actions when indications of degradation are found.

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

UFSAR Supplement. LRA Section 18.1.8 provides the UFSAR supplement for the BWR CRD Return Line Nozzle Program, as amended by letter dated October 13, 2009. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.1-2.

The staff noted that as part of its response to RAI-B.3.8-1 and RAI-B.3.8-2, the applicant revised the last paragraph of LRA Section 18.1.8. The staff further noted that after the revision, the paragraph reads:

> This program is consistent with the ten elements of NUREG-1801 XI.M6 with two exceptions. The method of blocking the return line uses a blind flange instead of cutting and capping the line. The nozzle inspection frequency is based on ASME Code Section XI instead of NUREG-0619.

The staff finds this change to LRA Section 18.1.8 to be acceptable because it correctly describes the acceptable exceptions to GALL AMP XI.M6, as discussed above.

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

Conclusion. On the basis of its audit and review of the applicant's BWR CRD Return Line Nozzle 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 its justification 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, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.9 BWR Feedwater Nozzle Program

Summary of Technical Information in the Application. LRA Section B.3.9 describes the existing BWR Feedwater Nozzle Program as consistent with GALL AMP XI.M5, "BWR Feedwater Nozzle." The applicant stated that its program consists of the ASME Section XI Inservice Inspection Program and the ASME Section XI Augmented Inspection Program, as well as system modifications and operator instructions. The applicant stated the ASME Section XI Augmented Inspection Program performs periodic ultrasonic inspections of critical regions of the feedwater nozzle. The applicant also stated that the unique feedwater nozzle/sleeve design prevents the flow of cold water behind the thermal sleeve which reduces the risk of cracking due to thermal cycling. The applicant further stated that it has implemented changes to the controls of the feedwater regulating valves and placed cautions in operating procedures.

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

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M5. As discussed in the Audit Report, the staff confirmed that these elements are consistent with the corresponding elements of GALL AMP XI.M5. Based on its audit, the staff finds that elements one through six of the applicant's BWR Feedwater Nozzle Program are consistent with the corresponding program elements of GALL AMP XI.M5 and, therefore, acceptable.

Operating Experience. LRA Section B.3.9 summarizes operating experience related to the BWR Feedwater Nozzle Program. The staff confirmed that, because of the plant-specific feedwater nozzle/thermal sleeve design, the applicant's feedwater nozzles do not suffer from the same degradation as reported in other BWR reactor designs. The staff noted the results of ultrasonic inspections of the applicant's feedwater nozzles conducted in 2005 and 2007 were reviewed and found to be satisfactory.

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

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

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

UFSAR Supplement. LRA Section 18.1.9 provides the UFSAR supplement for the BWR Feedwater Nozzle Program. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.1-2.

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

Conclusion. On the basis of its audit and review of the applicant's BWR Feedwater Nozzle Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.10 BWR Penetrations Program

Summary of Technical Information in the Application. LRA Section B.3.10 describes the existing BWR Penetrations Program as consistent with GALL AMP XI.M8, "BWR Penetrations." The applicant stated that its program manages the aging effects of cracking and performs UT volumetric, surface, and visual inspections. The applicant explained that the guidelines in Boiling Water Reactor Vessel and Internals Program (BWRVIP)-49-A for instrument penetrations and BWRVIP-27-A for the standby liquid control (SLC) system are incorporated into the BWR Penetrations Program. The applicant further stated that the monitoring and control of reactor coolant water chemistry is in accordance with applicable BWRVIPs, which are implemented by its Water Chemistry Program.

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

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M8. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M8, with the exception of the "scope of the program," "preventive actions," "detection of aging effects," and "acceptance criteria" program elements. For these elements, the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

The staff noted that the “scope of the program” program element of the applicant’s program basis document states that the program manages the aging effects for the components in the systems and structures listed in the AMRs identified in this document. However, the staff noted that the applicant did not provide a detailed description of the welds covered by the BWRVIP-27-A and BWRVIP-49-A that should be included in its BWR Penetrations Program. The staff reviewed documents such as the BWRVIP and the ISI administrative documents but did not find a clear description of the welds included in the applicant’s BWR Penetrations Program, in accordance with the components discussed in BWRVIP-49-A. Furthermore, the staff noted that the references for welds addressed by the BWRVIP-27-A in the BWRVIP administrative document do not correspond to those of the applicant’s program basis document. By letter dated September 14, 2009, the staff issued RAI B.3.10-7 requesting the applicant clarify which welds covered by BWRVIP-27-A and BWRVIP-49-A are included in its BWR Penetrations Program.

In its response dated October 13, 2009, the applicant stated that the welds that are included in the BWR Penetrations Program are the nozzle-to-safe-end welds and nozzle-to-vessel welds for N10 nozzle (core differential pressure and SLC nozzle) and the N11A/B, N12A/B, and N16A/B nozzles (instrumentation nozzles). The welds associated with the N10 nozzle are covered under the BWRVIP-27-A, “BWR Vessel and Internals Project BWR Standby Liquid Control/Core Plate ΔP Inspection and Flaw Evaluation Guidelines.” The applicant stated that these welds are included in the components that are identified in its program basis document as 1T201-DP/SLC-NOZZLE and 1T201-DP/SLC-SAFEEND. Furthermore, the applicant stated that the welds associated with the N11A/B, N12A/B, and N16A/B nozzles are covered under the BWRVIP-49-A, “BWR Vessel and Internals Project, Instrumentation Penetration Inspection and Flaw Evaluation Guidelines.” The applicant stated that these welds are included in the components that are identified in its program basis document as 1T201-INST-SAFEEND and 1T201-INST-NOZZLE.

Based on its review, the staff found this part of the applicant’s response to RAI B.3.10-7 acceptable because the description of the welds included in the BWR Penetrations Program was clear. The staff’s concern described in RAI B.3.10-7 is resolved.

However, in its response to RAI B.3.10-7, the applicant further stated that the LRA indicates that some nozzles are incorrectly managed by the BWR Penetrations Program. These AMR line items are discussed in more detail relative to RAI 3.1.2.1-a. The staff’s review and evaluation for these AMR line items and RAI 3.1.2.1-a are documented in SER Section 3.1.2.1.2.

The staff noted that the “scope of the program” program element of the applicant’s program basis document states that its program manages the aging effects for the components in the systems and structures listed in the AMRs identified in this basis document. The applicant’s program basis document states that the aging effects for the components are SCC/intergranular attack (IGA). The “scope of the program” program element of GALL AMP XI.M8 states that the program is focused on managing the effects of cracking due to SCC or IGSCC. The staff noted that it is not clear that the applicant’s statement is consistent with the GALL Report because the components of concern for the applicant’s BWR Penetrations Program are stainless steel and their environment is reactor coolant. Thus, the aging effect should be IGSCC, not IGA. By letter dated September 14, 2009, the staff issued RAI B.3.10-8 requesting the applicant discuss its plan to modify its basis document accordingly.

In its response dated October 13, 2009, the applicant stated that IGA is not totally similar to SCC and is distinguished from SCC in that stress is not necessary for it to proceed. The applicant explained that, for stainless steels and CASS materials, SCC and IGA are grouped together in the “Mechanical Tools” of EPRI TR-1010639, “Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 4” in Section 3.2.2, and are used as the basis for determining how aging effects for material and environment conditions should be addressed for license renewal. The applicant explained that its program basis document just reflects the terminology that was used in the license renewal software program where the selection “SCC/IGA” was provided to signify that cracking was an applicable aging effect. For the applicant, since the discussion in the LRA is limited in most cases to discussing the aging effect of cracking, the question of which aging mechanism caused the aging effect of cracking is not usually germane to aging management.

Based on its review, the staff finds the applicant’s response to RAI B.3.10-8 acceptable because regardless of which aging mechanism (SCC or IGA) was identified that might initiate cracking, the inspection techniques for identifying cracking are the same and are appropriate and capable of detecting this aging effect. The staff’s concern described in RAI B.3.10-8 is resolved.

The staff noted that the “preventive actions” program element in the applicant’s program basis document states that the monitoring and control of reactor coolant water chemistry is in accordance with applicable BWRVIP reports, which are implemented by its Water Chemistry Program. The applicant also stated that its Water Chemistry Program is consistent with GALL AMP XI.M2. The “preventive actions” program element of GALL AMP XI.M8 states that reactor coolant water chemistry is monitored and maintained in accordance with the guidelines in BWRVIP-29. The applicant’s program basis document also states that the control of water chemistry per the EPRI guidelines of BWRVIP-130, “BWR Water Chemistry Guidelines,” 2004 Revision is not considered an exception to GALL AMP XI.M2. However, the staff noted that this is an exception to the GALL AMP XI.M8 because the applicant implemented the water chemistry guidelines through procedures based on another BWRVIP report rather than the one recommended by the GALL Report. Furthermore, the staff noted that the applicant did not refer to the same procedures and the same BWRVIP reports for water chemistry according to its implementing documents. By letter dated September 14, 2009, the staff issued RAI B.3.10-1 requesting the applicant clarify the BWRVIP report used for water chemistry guidelines and justify its acceptability if BWRVIP-29 is not used, as well as to clarify which procedure is used to implement the water chemistry guidelines.

In its response dated October 13, 2009, the applicant explained that it uses the BWRVIP-130, “BWR Water Chemistry Guidelines,” October 2004 as a basis for the plant water chemistry control and it is in the process of updating BWRVIP-190, “BWR Water Chemistry Guidelines,” 2008 Revision. The applicant stated that the use of either BWRVIP-130 or BWRVIP-190 water chemistry guidelines is fully consistent with GALL AMP XI.M2. The applicant referred to the last sentence of the “preventive actions” program element of GALL AMP XI.M8 that states, “The program description and the evaluation and technical basis of monitoring and maintaining reactor water chemistry are presented in Chapter XI.M2, ‘Water Chemistry.’” The applicant also stated that the Water Chemistry Program for BWR penetrations is the same chemistry program applied to the entire RCS and cannot have a different standard than found acceptable for the rest of the RCS. Therefore, the applicant considered that the use of a BWRVIP water chemistry standard found acceptable in GALL AMP XI.M2, even if not explicitly listed by number in GALL AMP XI.M8, is not an exception. The staff finds the applicant’s conclusion acceptable because GALL AMP XI.M8 explicitly refers to GALL AMP XI.M2, which itself allows the use of industry guidelines such as BWRVIP-29 (EPRI TR-103515) or later revisions for monitoring and control of reactor water chemistry.

The applicant further stated that it uses a newer revision of its procedures to implement the water chemistry guidelines for the RCS and that the BWR Penetrations program basis document should have referenced this revision instead of the revision referenced in this basis document.

Based on its review, the staff finds the applicant response to RAI B.3.10-1 acceptable because the applicant clarified how the BWR Water Chemistry Guidelines Revision it uses is consistent with the recommendations in the GALL AMP XI.M8 and GALL AMP XI.M2 and which procedure it uses for the water chemistry of the RCS. The staff's concern described in RAI B.3.10-1 is resolved.

The staff noted that the "detection of aging effects" program element of the applicant's program basis document states that alternatives for examinations for categories B-F and B-J have been incorporated into the BWR Penetrations Program. These alternatives are based on a risk-informed methodology. The corresponding GALL Report AMP states that the evaluation guidelines of BWRVIP-49-A and BWRVIP-27-A recommend that the inspection requirements currently in ASME Section XI continue to be followed. It is not clear to the staff that these statements are consistent because the alternatives are approved only for the current 10-year interval. Moreover, the staff noted that the alternatives are based on a risk-informed methodology, which is not described in the guidelines of BWRVIP-27-A or BWRVIP-49-A. By letter dated September 14, 2009, the staff issued RAI B.3.10-2 requesting the applicant clarify how the inspections described in BWRVIP-27-A and BWRVIP-49-A will be implemented during the period of extended operation and modify its application as necessary.

In its response dated October 13, 2009, the applicant stated that during the period of extended operation, the inspections described in BWRVIP-27-A and BWRVIP-49-A will be performed in accordance with these BWRVIP reports and categories B-F and B-J of ASME Code requirements, unless approval has been received from the staff for relief or use of an alternative, in accordance with 10 CFR 50.55(a).

The staff finds the applicant's response to RAI B.3.10-2 acceptable because the applicant does not credit any relief request or use of an alternative for the period of extended operation and will include this in its program basis document. The staff's concern described in RAI B.3.10-2 is resolved.

The staff noted that the "detection of aging effects" program element in the applicant's program basis document states that further details for examination are described in its program basis document for the ASME XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program. The staff noted that this document does not refer to its program basis document for the BWR Penetrations Program. By letter dated September 14, 2009, the staff issued RAI B.3.10-3 requesting the applicant explain how it takes the program basis document for the BWR Penetrations Program into account into the program basis document for the ASME XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program.

In its response dated October 13, 2009, the applicant explained that the "detection of aging effects" program element of the applicant's program basis document for the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program cross-references the program basis document for the BWR Penetrations Program. The applicant indicated that its program basis document states that it implements the requirements of applicable approved BWRVIPs and that the BWRVIPs credited for aging management for license renewal are discussed in different program basis documents, among which is the one for the BWR Penetrations Program. The applicant further stated that the "detection of aging effects" program element of GALL AMP XI.M8 acknowledges that, "The evaluation guidelines of BWRVIP-49 and BWRVIP-27 recommend that the inspection requirements currently in ASME Section XI continue to be followed." The staff noted that for the applicant, there are no exceptions or augmented requirements related to BWR penetrations that need to be discussed in the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. Therefore, the applicant considers that a general reference to the BWR Penetrations Program is sufficient.

Based on its review, the staff finds the applicant's response to RAI B.3.10-3 acceptable because the applicant clarified how it takes into account the guidance of its BWR Penetrations Program into its ASME XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The staff's concern described in RAI B.3.10-3 is resolved.

The staff noted that the "detection of aging effects" program element in the applicant's program basis document states that the guidelines in BWRVIP-03 are also being followed. The "detection of aging effects" program element of GALL AMP XI.M8 states that the nondestructive examination (NDE) techniques appropriate for inspection of BWR vessels internals, including the uncertainties inherent in delivering and executing NDE techniques in a BWR, are included in BWRVIP-03. The staff noted that it is not clear that these statements are consistent because it did not find any reference to this BWRVIP report in the implementing documents the staff reviewed during its audit. By letter dated September 14, 2009, the staff issued RAI B.3.10-4 requesting the applicant explain how it takes the guidance of this BWRVIP report for "detection of aging effects" program element into account in its BWR Penetrations Program.

In its response dated October 13, 2009, the applicant stated that its BWRVIP administrative document provides the program requirements for implementing the BWRVIP documents and covers individual components for which the inspection requirements have been identified by the BWRVIP Inspection and Evaluation Guidelines. The applicant further stated that the BWRVIP administrative document identifies that the applicable inspection guideline is BWRVIP-03 for various reactor vessel internals (RVIs) components including instrument and SLC penetrations. The staff noted that for the applicant, this is the mechanism that assures that the guidance of the BWRVIP report for detection of aging effects is taken into account in its BWR Penetrations Program.

Based on its review, the staff finds the applicant's response to RAI B.3.10-4 acceptable because it clarifies how it takes into account the guidance of BWRVIP-03, consistent with the recommendations of the "detection of aging effects" program element of GALL AMP XI.M8. The staff's concern described in RAI B.3.10-4 is resolved.

The staff noted that the "acceptance criteria" program element in the applicant's program basis document states the evaluation of crack growth is in accordance with article IWB-3000 of ASME Code Section XI with guidance from BWRVIP-14, BWRVIP-59, and BWRVIP-60. The "acceptance criteria" program element of GALL AMP XI.M8 states that applicable and approved BWRVIP-14, BWRVIP-59, and BWRVIP-60 documents provide guidelines for evaluation of crack growth in different alloys. The staff noted that it is not clear that these statements are consistent because it did not find any reference to these three BWRVIP reports in the implementing documents the staff reviewed during its audit. By letter dated September 14, 2009, the staff issued RAI B.3.10-5 requesting the applicant explain how it takes the guidance of these BWRVIP reports for the "acceptance criteria" program element into account in its BWR Penetrations Program.

In its response dated October 13, 2009, the applicant amended its LRA to include Commitment No. 42, which states:

> The implementing document for the BWR Penetrations Program will be revised to specify that guidance in BWRVIP-14, -59 and -60 is to be considered in the evaluation of crack growth in stainless steel, nickel alloys and low-alloy steels, respectively, when flaws are identified and evaluation required.

The applicant also stated that the revision will occur before the period of extended operation.

The staff noted that the applicant's use of the expression "*is to be considered*" does not mean the applicant is committed to taking into account the appropriate guidance from BWRVIP-14, -59, and -60 reports, in addition to the requirements of ASME Code Section XI, as recommended in the "acceptance criteria" program element GALL AMP XI.M8. By letter dated January 14, 2010, the applicant amended Commitment No. 42, which states:

> The implementing document for the BWR Penetrations Program will be revised to specify that guidance in BWRVIP-14, -59 and -60 will be used, as appropriate, depending on material, in the evaluation of crack growth in stainless steel, nickel alloys and low-alloy steels, respectively, when flaws are identified and evaluation required.

Based on its review, the staff finds the applicant's response to RAI B.3.10-5, as amended by letter dated January 14, 2010, acceptable because it is clear in Commitment No. 42 that the applicant is committed to following the recommendations of the "acceptance criteria" program element of GALL AMP XI.M8. The staff's concern described in RAI B.3.10-5 is resolved.

Based on its audit and review of the applicant's responses to RAIs B.3.10-1, B.3.10-2, B.3.10-3, B.3.10-4, B.3.10-5, B.3.10-7, and B.3.10-8, the staff finds that elements one through six of the applicant's BWR Penetrations Program are consistent with the corresponding program elements of GALL AMP XI.M8 and, therefore, acceptable.

In LRA Appendix C, the applicant provided its answers to the four renewal applicant action items (RAAIs) of the safety evaluation the staff issued for BWRVIP-27-A (LRA Table C-4) and to the three RAAIs of the safety evaluation the staff issued for BWRVIP-49-A (LRA Table C-9). The staff confirmed that, consistent with the responses to the RAAIs, the applicant included in the LRA all relevant RAAI request information that was applicable to its CLB or else justified why the RAAI was not applicable to the LRA. Based on its review, the staff concludes that the applicant has adequately addressed these RAAIs.

<u>Operating Experience</u>. LRA Section B.3.10 summarizes operating experience related to the BWR Penetrations Program. The applicant stated in LRA Section B.3.10, as well as in the operating experience document provided by the applicant for the audit, that its operating experience demonstrates that the current Inservice and Augmented Inspection Programs are effective in managing the aging effect of cracking in the BWR penetration nozzles. The applicant further stated that the program is effective in finding flaws prior to loss of intended function as demonstrated on other penetration, nozzle, and safe-end welds.

The applicant also stated that its BWR Penetrations Program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended functions throughout the period of extended operation.

In LRA Section B.3.10, the applicant provided examples of plant-specific operating experience. One example the applicant provided relates to inspections of welds susceptible to IGSCC and performed during RFO 16. The staff noted these inspections identified flaw indications on three recirculation riser nozzle-to-safe-end welds (RRB-F002, RRD-F002, and RRF-F002) and the original scope of the examinations included three recirculation riser and one core spray nozzle-to-safe-end welds. The staff noted that the inspection scope was, therefore, expanded to include all of the remaining F002 welds, as well as the other similarly designed core spray welds.

The staff noted that weld overlays using IGSCC-resistant alloy 52 were completed on the RRB and RRD riser F002 welds and on the RRF-F002 weld. A review was performed of the 1996 and 1999 automated data, and the applicant has determined that the weld crown geometry did not allow adequate access to disposition the indication. Therefore, as a result, the applicant performed additional scans after the weld had been ground flush. The staff noted that the re-inspection showed that the flaw was subsurface with no connection to the inside or outside surface of the piping. The applicant's review of the 1978/1979 radiographs and repair records confirmed that this was likely a small area of internal incomplete fusion between weld beads and not attributable to IGSCC. It also confirmed that the flaw was evaluated under the ASME Code and determined to be acceptable to leave as-is due to the size and lack of exposure to the surface. Overlays on RRB-F002 and RRD-F002 have been re-inspected by the applicant during RFO 17, in addition to the re-inspection of RRF-F002.

The staff noted that the second example relates to ultrasonic examinations performed during the 2007 RFO 20, in accordance with the BWRVIP-75 and ASME Section XI Inservice Inspection programs, which identified an indication in reactor recirculation riser safe-end-to-nozzle weld RRF-F002. The staff noted the indication did not meet ASME Section XI acceptance criteria and a scope expansion was required, which identified another indication that did not meet ASME Section XI acceptance criteria (in safe-end-to-nozzle weld RRF-F002). The staff noted that both welds were subsequently overlaid. The staff further noted the indications in both welds (RRF-F002 and RRC-F002) were determined to be IGSCC. The applicant performed a root cause (RCE 1062) and concluded that, based on the fact that the site is operated on hydrogen water chemistry (HWC), it is very likely that both flaws have been present for a significant time (e.g., multiple cycles) and were not identified by previous inspections. The staff noted that a staff requested review by Pacific Northwest National Laboratory substantiates this conclusion.

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

During its review, the staff identified operating experience, which could indicate that the applicant's program may not be effective in adequately managing aging effects during the period of extended operation. The staff determined the need for additional clarification, which resulted in the issuance of an RAI.

The staff noted that the applicant based its statement on the finding of indications in welds not included in the BWR Penetrations Program. By letter dated September 14, 2009, the staff issued RAI B.3.10-6 requesting the applicant explain how the operating experience deduced from these indications can be applied for the BWR Penetrations Program and identify any operating experience specific to the BWR penetration nozzles.

In its response dated October 13, 2009, the applicant stated that the intent of the referenced discussion was to show that it has a robust NDE program, which is successful in identifying indications, in general. The applicant also explained that inspections of specific welds and penetrations, included in the BWR Penetrations Program, have been performed, and that these inspections (based on ultrasonic, surface, and visual examinations) showed acceptable results.

Based on its review, the staff finds the applicant's response to RAI B.3.10-6 acceptable because the applicant clarified that inspections of specific welds and penetrations, included in the BWR Penetrations Program, have been performed with acceptable results. Through its NDE program, the applicant was capable of identifying the crack indications and then taking appropriate corrective actions by expanding inspections and performing additional examinations during following outages. The staff's concern described in RAI B.3.10-6 is resolved.

Based on its audit and review of the application, and review of the applicant's response to RAI B.3.10-6, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

UFSAR Supplement. LRA Section A.18.1.10 provides the UFSAR supplement for the BWR Penetrations Program. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.1-2.

The staff also notes that the applicant committed (Commitment No. 42), by letter dated October 13, 2009, to ongoing implementation of the existing BWR Penetrations Program for managing aging of applicable components during the period of extended operation. Specifically, the applicant committed that the implementing document for the BWR Penetrations Program will be revised to specify that guidance in BWRVIP-14, -59, and -60 will be used, as appropriate, depending on material, in the evaluation of crack growth in stainless steel, nickel alloys, and low-alloy steels, respectively, when flaws are identified and evaluation required.

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

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

3.0.3.1.11 BWR Stress Corrosion Cracking Program

Summary of Technical Information in the Application. In LRA Section B.3.12, the applicant described the BWR Stress Corrosion Cracking Program as an existing program that is consistent with GALL AMP XI.M7, “BWR Stress Corrosion Cracking.” The applicant did not take any exception to GALL AMP XI.M7, and did not implement any enhancement to the GALL AMP. The applicant further stated that it complies with the requirements specified in NUREG-0313, Revision 2, “Technical Report on Material Selection and Process Guidelines for BWR Coolant Pressure Boundary Piping,” Generic Letter (GL) 88-01, Supplement 1, “NRC Position on Intergranular Stress Corrosion Cracking (IGSCC) in BWR Austenitic Stainless Steel Piping,” and BWRVIP-75, “BWR Vessel and Internals Project, Technical Basis for Revisions to GL 88-01 Inspection Guidelines.” The mitigation program implemented by the applicant includes: (1) replacement of susceptible materials with crack resistant materials (i.e., low carbon grade stainless steel materials or installation of weld overlay repairs), (2) solution annealing or induction heating stress improvement of susceptible areas, and (3) implementation of HWC. Categories A through G stainless steel welds were inspected and these inspections were consistent with the inspection requirements specified in BWRVIP-75.

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

The staff reviewed the BWR Stress Corrosion Cracking Program and confirmed the applicant’s claim of consistency with GALL AMP XI.M7. The staff confirmed that the plant program contains all of the elements of the referenced GALL AMP XI.M7. Implementation of program requirements specified in NUREG-0313, Revision 2, GL 88-01, Supplement 1 and the BWRVIP-75-A report provides adequate assurance that aging degradation due to IGSCC is effectively monitored in RCS components. During the audit review, the staff noted that the program elements in the applicant’s AMP are consistent with GALL AMP XI.M7.

During its audit, the staff also conducted an independent database search and found that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff).

The applicant implemented structural weld overlays on the RRB-F002 and RRD-F002 welds. In 2007, identification of rejectable IGSCC indications (per ASME Code Section XI) in the safe-end-to-nozzle weld RRF-F002 prompted the applicant to apply a structural weld overlay. The applicant concluded that it was very likely the flaws in this weld have been present for a significant time and were not identified during previous examinations. The staff conducted an independent review of the previous ISI examination results and concluded that the flaws were not identified during previous examinations.

After reviewing the applicant’s operating experience, the staff issued RAI B.3.12-2 by letter dated September 24, 2009**,** requesting that the applicant provide the following information regarding the recirculation riser nozzle-to-safe-end welds (RRB-F002, RRD-F002, and RRF-002): (1) type of the weld materials that were originally used to fabricate these welds, (2) mitigation technique (e.g., stress improvement) that was implemented, if any, on these welds prior to the identification of IGSCC, (3) confirm whether these cracks were through-wall prior to the application of the weld overlays, and (4) future inspection plans for these welds.

In a letter dated October 23, 2009, the applicant stated that the original welds were fabricated with 82/182 weld metals and no mitigation techniques were implemented on these welds. The welds did not show any through-wall leaks prior to the application of the structural weld overlays. The applicant stated that recent examinations of the weld overlays on RRB-F002 and RRD-F002 welds revealed no indications and that the applicant has no plans to inspect these weld overlays again during the current license period. The applicant intends to inspect the weld overlays on RRC-F002 and RRF-F002 welds during 2010. The staff reviewed this response and expects the applicant to comply with ASME Code Section XI and the BWRVIP-75-A inspection requirements for the RRB-F002 and RRD-F002 welds. The staff accepts this response because: (1) the applicant is in compliance with the inspection requirements specified in the staff-approved BWRVIP-75-A for these welds, (2) inspections of the RRB-F002 and RRD-F002 welds showed no active degradation, and (3) the applicant's proposal to conduct subsequent inspections of the RRC-F002 and RRF-F002 weld overlays will identify any aging degradation in these welds. Therefore, the staff considers its concerns related to RAI B.3.12-2 are resolved.

The staff finds that the applicant adequately addressed its operating experience in this AMP. The staff finds that the applicant properly implemented the inspection requirements that are consistent with GALL AMP XI.M7, the ASME Code Section XI Inservice Inspection Program, and BWRVIP-75-A. The staff concludes that the implementation of the BWR Stress Corrosion Cracking Program adequately manages IGSCC because: (1) the applicant implemented the inspection methods are consistent with the aforementioned requirements, (2) the applicant adopted proper corrective actions to mitigate the non-conforming conditions, (3) the applicant continues to perform inspections per the requirements ASME Code Section XI ISI program and the BWRVIP-75-A report during the extended period of operation which will enable the applicant to identify IGSCC in a timely manner, and (4) the program elements in the BWR Stress Corrosion Cracking Program are consistent with the GALL Report AMP XI.M7 and the applicant did not take any exception to GALL Report AMP XI.M7.

Consistent with the requirements specified in GL 88-01, Supplement 1, the applicant included a portion of small bore piping (less than 4 inch NPD) in its Inservice Inspection Program. The applicant will continue to perform volumetric examinations per the ASME Code Section XI on small bore piping during the period of extended operation. In this context, by letter dated September 24, 2009, the staff issued RAI-B.3.12-1 requesting that the applicant provide the following information: (a) previous plant experience regarding the aging degradation of small bore piping welds, (b) type of prior inspections that were performed thus far on the small bore piping welds, and (c) inspection results followed by any corrective actions that were taken so far to prevent recurrence of any aging degradation in small bore piping welds.

In a letter dated October 13, 2009, the applicant stated that a plant-specific Small-Bore Piping Inspection Program was developed for ASME Code, Class 1 small bore piping. The staff's review of this AMP is discussed in Section AMP B.3.3 of the staff's safety evaluation.

Operating Experience. LRA Section B.3.12 summarizes operating experience related to the BWR Stress Corrosion Cracking Program. The applicant provided information regarding the detection of IGSCC in recirculation riser nozzle-to-safe-end welds (RRB-F002, RRD-F002, and RRF-F002). In its response dated October 23, 2009, the applicant included another weld, RRC-F002, that was subject to a structural weld overlay. The applicant stated that it completed weld overlays, as a preventive measure, on the RRB-F002, RRC-F002 and RRD-F002 welds. In 2007, NDE, which included UT, was performed on weld RRF-F002 and it resulted in identification of rejectable indications in the riser safe-end-to-nozzle weld.

Based on its root cause evaluation, the applicant concluded that it was very likely the flaws have been present for a significant time and were not identified during previous inspections. The applicant stated that the staff, during the integrated inspection in 2007, did not identify any ISI program deficiencies, but some deficiencies were noted in the ISI implementation program.

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

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

UFSAR Supplement. In Appendix A of LRA Section 18.1.12, the applicant provided the UFSAR supplement for the BWR Stress Corrosion Cracking Program. The staff reviewed this section and found that it complies with the guidelines of GALL AMP XI.M7. The UFSAR supplement also satisfies the guidelines of SRP-LR Table 3.1-2. The staff determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's BWR Stress Corrosion Cracking Program, including the applicant's response to staff RAIs, the staff finds all program elements consistent with GALL AMP XI.M7. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.12 BWR Vessel ID Attachment Welds Program

Summary of Technical Information in the Application. LRA Section B.3.13 describes the existing BWR Vessel ID Attachment Welds Program as consistent with GALL AMP XI.M4, "BWR Vessel ID Attachment Welds." The applicant stated that this program entails: (a) inspection and evaluation in accordance with the guidelines of the staff-approved BWRVIP-48-A, "BWR Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines," (b) monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-130, "Water Chemistry," to ensure the long-term integrity and safe operation of reactor pressure vessel (RPV) ID attachment welds and support pads, and (c) conducting ISI in accordance with the ASME Code Section XI, 2001 edition through 2003 Addenda.

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 (EPRI-008192), which is a later revision to BWRVIP-29, “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’s review of the BWR Vessel ID Attachment Welds Program also confirmed that the boundary conditions of the AMP were enveloped by the boundary conditions described in GALL AMP XI.M4.

The staff also reviewed the operating experience described in LRA Section B.3.13. The applicant stated that the frequency and the method of inspection specified in BWRVIP-48-A will be implemented for the attachment welds. Consequently, by letter dated September 24, 2009, the staff issued RAI B.3.13-1 requesting that the applicant identify if any furnace-sensitized stainless steel materials exist in the vessel ID attachment welds at DAEC and provide details on how the AMP is implemented (i.e., any additional augmented inspection program for the furnace-sensitized stainless steel materials). These requirements apply to, but are not limited to, jet pump raiser brace attachments, core spray piping bracket attachments, steam dryer support and hold-down brackets, feedwater spargers, guide rods, and surveillance sample holders.

In a letter dated October 23, 2009, the applicant stated that furnace-sensitized stainless steel materials were not used in the aforementioned RVI components. The staff accepts this response and considers its concern related to RAI B.3.13-1 is resolved.

Based on its review, the staff considers the BWR Vessel ID Attachment Welds Program acceptable because: (1) inspection requirements per ASME Code Section XI and BWRVIP-48-A would effectively identify any aging degradation in a timely manner; (2) inspections performed thus far indicated that no repairs were required for these welds, which substantiates the adequacy of the implementation of the BWRVIP-48-A requirements; (3) effective control of water chemistry with HWC in conjunction with noble metal chemical addition (NMCA) does mitigate IGSCC in welds where protection due to HWC and NMCA is expected; and (4) the applicant’s continuous compliance with the BWRVIP programs and ASME Code Section XI requirements would effectively monitor the aging degradation in RPV ID attachment welds during the license renewal period.

<u>Operating Experience</u>. LRA Section B.3.13 summarizes operating experience related to the BWR Vessel ID Attachmnent Welds Program. The applicant stated that previous inspections that were conducted thus far on the vessel ID attachment welds did not result in any repairs, which substantiates the applicant’s claim that the implementation of the BWR Vessel ID Attachment Welds Program is effective at DAEC. The applicant further stated that the ISI activities during the 2006 outage were implemented satisfactorily with the exception of an incorrect reference to the applicable weld examination. The NRC integrated inspection in 2007 identified that even though ISI program requirements are acceptable, implementation of the ISI program has some deficiencies at DAEC. The applicant initiated improvement activities to prevent recurrence of deficiencies in the ISI program.

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

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

UFSAR Supplement. In Appendix A of LRA Section 18.1.13, the applicant provided the UFSAR supplement for the BWR Vessel ID Attachment Welds Program. The staff reviewed this section and found that it complies with the guidelines of GALL AMP XI.M4. The UFSAR supplement also satisfies the guidelines of SRP-LR Table 3.1-2. The staff determines that the information in the UFSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's BWR Vessel 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, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.13 Closed-Cycle Cooling Water System Program

Summary of Technical Information in the Application. LRA Section B.3.15 describes the existing Closed-Cycle Cooling Water System Program as consistent, with an exception, with GALL AMP XI.M21, "Closed-Cycle Cooling Water System." The applicant stated that this is an existing program that is used to manage the effects of corrosion, fouling, heat transfer degradation, and SCC in the reactor building closed cooling system, the control building chiller closed-cycle cooling water system, the off-gas condenser closed-cycle cooling water system, and the standby diesel generator jacket coolers. The applicant also stated that the program procedures and guidance documents are based upon the EPRI TR-107396, "Closed Cooling Water Chemistry Guideline, Revision 0." The applicant further stated that the program includes control of chemistry parameters to minimize corrosion and SCC, and includes testing and inspections to ensure that the closed-cycle cooling water system's performance is maintained and that the intended functions of the components within the scope of the program are not compromised.

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

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M21. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M21, with the exception of the "preventive actions," "parameters monitored or inspected," and "monitoring and trending" program elements. For these elements, the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

GALL AMP XI.M21 recommends the use of EPRI TR-107396. LRA Section B.3.15 states that the program is based on EPRI TR-107396; however, during its audit, the staff found that the applicant's program technical basis documents are based upon EPRI TR-1007820, "Closed Cooling Water Chemistry Guideline, Revision 1." By letter dated September 14, 2009, the staff issued RAI B.3.15-1 requesting that the applicant state which version of the EPRI document is the basis for its program.

In its response dated October 13, 2009, the applicant stated that it will use EPRI TR-1007820 as the applicable closed-cycle cooling water standard.

The staff finds the applicant's response to RAI B.3.15-1 acceptable because EPRI TR-1007820 is the current EPRI guideline and incorporates more operating experience than that contained in the original document. The staff further notes that the current draft revisions to the GALL Report incorporate EPRI TR-1007820 in place of EPRI TR-107396. The staff's concern described in RAI B.3.15-1 is resolved.

GALL AMP XI.M21 recommends the use of EPRI TR-107396 which states that various controlled parameters can have a negative synergistic effect on system corrosion rates. If two of these controlled parameters are outside the normal operating range at the same time, the action level may need to be increased one step higher than the current level; however, during its audit, the staff found that applicant's program does not account for any potential negative synergistic effect of two controlled parameters being out of compliance at the same time. By letter dated September 14, 2009, the staff issued RAI B.3.15-2 requesting that the applicant provide additional information describing whether any specific actions other than the Level 1 or Level 2 actions would be taken if more than one control parameter is out of compliance with EPRI TR-107396.

In its response dated October 13, 2009, the applicant stated that the program guidance has been revised such that in the event that more than one control parameter is out of compliance with the established guidelines, a more aggressive corrective action will be initiated than if only one control parameter was out of compliance.

Based on its review, the staff finds the applicant's response acceptable because the new procedure reflects the guidance provided in EPRI TR-1007820. The staff's concern described in RAI B.3.15-2 is resolved.

GALL AMP XI.M21 recommends the use of EPRI TR-107396, which in turn recommends that azoles be used to control corrosion in closed-cycle cooling water systems containing copper; however, during its audit, the staff found that the reactor building closed-cycle cooling water system contains copper, but does not use azoles to manage the corrosion in this system. By letter dated September 14, 2009, the staff issued RAI B.3.15-3 requesting that the applicant provide additional information describing why azoles are not used and monitored in the reactor building closed-cycle cooling water system.

In its response dated October 13, 2009, the applicant stated that the plant does not need to use azoles, because the concentration of copper in the water has been historically below 100 parts per billion (ppb), which is well below the industrial best practice of 200 ppb. The applicant also stated that the use of azoles in this application would be unlikely to provide a measurable reduction in the system's soluble copper levels.

Based on its review, the staff finds the applicant's response to RAI B.3.15-3 not acceptable because for a filtered sample, the solubility of copper at pH values typical of closed systems is 100 ppb or less. The test results indicating 100 ppb dissolved copper do not, therefore, indicate that the corrosion rate of copper is low as all corroded copper in excess of approximately 100 ppb would precipitate and would not be measured in the test. In a telephone conversation on January 22, 2010, the staff discussed with the applicant the need for additional information. By letter dated February 22, 2010, the staff issued RAI B.3.15-X requesting that the applicant provide additional information supporting the conclusion that the corrosion rate of copper is sufficiently low that copper corrosion inhibitors are not required or explain what alternative testing will be performed to ensure an accurate measure of soluble and suspended copper can be obtained.

In its response dated March 9, 2010, the applicant stated that the copper in the reactor building closed cooling water chemistry (RBCCW) is analyzed using an inductively coupled plasma spectrophotomer (ICP), which evaluates both dissolved and suspended copper particulates. The applicant also stated that the total copper concentration in the RBCCW has historically ranged between 35 and 140 ppb. The applicant further stated that this is below the GE Water and Process Technologies Best Practices of 200 ppb total copper concentration. Finally, the applicant stated that copper concentrations in other closed-cycle cooling water systems have been observed as high as 1,800 ppb even with the addition of azoles.

The staff finds this program acceptable because the applicant is monitoring the copper concentration in the RBCCW concentration, which provides an indication of copper corrosion. In addition, the staff finds this program acceptable for the RBCCW because the applicant has a historical baseline copper concentration value to compare against current and future measured values in order to determine if further corrosion of copper components is occurring. The staff's concern described in RAIs B.3.15-3 and B.3.15-X is resolved.

The staff also reviewed the portions of the "preventive actions," "parameters monitored or inspected," and "monitoring and trending" program elements associated with an exception to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this exception follows.

Exception 1. LRA Section B.3.15, as amended by letter dated October 13, 2009, states an exception to the "preventive actions," "parameters monitored or inspected," and "monitoring and trending" program elements. In its response to RAI B.3.15-1, the applicant stated that it will use EPRI TR-1007820 in place of the GALL Report recommended EPRI TR-107396. The staff reviewed this exception to the GALL Report and noted that the applicant took the exception because EPRI TR-1007820 is a later revision of the document referenced in GALL AMP XI.M21. The staff finds the applicant's exception acceptable because EPRI TR-1007820 is the current EPRI guideline and incorporates more operating experience than that contained in the original document. The staff further notes that the current draft revision to the GALL Report incorporates EPRI TR-1007820 in place of EPRI TR-107396.

Based on its audit and review of the applicant's response to RAIs B.3.15-1, B.3.15-2, and B.3.15-3, the staff finds that elements one through six of the applicant's Closed-Cycle Cooling Water System Program, with acceptable exception, are consistent with the corresponding program elements of GALL AMP XI.M21 and, therefore, acceptable.

Operating Experience. LRA Section B.3.15 summarizes operating experience related to the Closed-Cycle Cooling Water Program. The applicant stated that the program has been effective in managing the aging effects of corrosion, fouling and heat transfer degradation, and SCC. The applicant also stated that the program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these systems will continue to perform their intended functions throughout the period of extended operation. The applicant further stated that a review of plant operating experience related to the program shows that it has been successful at identifying chemistry parameters that were out of acceptable tolerances and addressing these in the corrective action program. The applicant did not provide additional information on any particular operating experience in the LRA; however, during its audit, the staff identified some additional operating experience indicating possible trends in chloride ingress and molybdate falling below plant action levels. The applicant stated that these trends are being addressed, or had been corrected, in its corrective action program.

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

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

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

UFSAR Supplement. LRA Section 18.1.15 provides the UFSAR supplement for the Closed-Cycle Cooling Water System Program. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Tables 3.1-2, 3.2-2, 3.3-2, and 3.4-2.

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

Conclusion. On the basis of its audit and review of the applicant's Closed-Cycle Cooling Water System Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and 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 the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.14 Compressed Air Monitoring Program

Summary of Technical Information in the Application. LRA Section B.3.16 describes the existing Compressed Air Monitoring Program as consistent with GALL AMP XI.M24, "Compressed Air Monitoring." The program manages or mitigates the aging effects of corrosion by assuring an oil free dry air environment in the instrument air system. The program consists of planned and periodic maintenance on the compressors and air dryers, as well as system monitoring. The applicant stated that the monitoring activities include a quarterly monitored blowdown along various portions of the system, a semi-annual air system quality check and a semi-annual swapping of the instrument air dryers.

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

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M24. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M24, with the exception of the areas identified below. For these areas the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

The applicant stated that this program manages and mitigates the aging effect of corrosion by assuring an oil free dry air environment in the instrument air system. Similarly, UFSAR Revision 14, Section 9.3.1.2.3, "Testing and Inspection Requirements," states the following: (1) the instrument and service air systems operate continuously and are observed and maintained during normal operations, (2) an instrument air system blowdown is performed periodically to remove any possible particulates from the system, and (3) an instrument air quality test is also performed periodically at various instrument air headers downstream of air driers. It also states this test is performed to verify that the air quality (dew point, particulate, and oil content) is consistent with the manufacturer's recommendation.

LRA Section 3.3.1.15, an AMR of the instrument air system, states that the Bolting Integrity Program, External Surfaces Monitoring Program, and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program are credited for aging management. LRA Section 3.3.1.27 states that the applicant credited the Compressed Air Monitoring Program for the safety-related air system to manage the aging effect of loss of material. UFSAR, Revision 14, Section 9.3.1.2.1, "Description" states that a safety-related air system is provided as a backup to the normal instrument air system for several critical safety-related components and systems. The staff noted that UFSAR Section 9.3.1.2 for the instrument and service air system is a subsection to UFSAR Section 9.3.1, "Compressed Air Systems," which implies that the instrument and service air system is included in the compressed air systems. The staff required additional information to clarify whether its program manages the aging effects and performs the relevant inspection, monitoring and testing for the applicant's instrument air system and safety-related air system consistent with the recommendations of the GALL Report.

By letter dated September 14, 2009, the staff issued RAI B.3.16-1 requesting that the applicant clarify: (1) why LRA Section 3.3.1.15 and LRA Table 3.3.2-15 for the instrument air system indicate that the Compressed Air Monitoring Program is not credited for aging management, which conflicts with the information from LRA Section B.3.16 and USFAR Section 9.3.1.2.3; (2) whether the Compressed Air Monitoring Program manages the aging effects of the compressed air systems, including the instrument air and safety-related air systems, and performs inspection, monitoring and testing for the systems in accordance with GALL AMP XI.M24 as the applicant claimed its consistency with the GALL Report; (3) why the LRA Section 18.1.16 includes only the instrument air system when the Compressed Air Monitoring Program is also credited for the safety-related air system; and (4) whether the description "instrument air system" in the UFSAR supplement needs to be changed to the "compressed air systems" or relevant system description terminology in such a way to encompass the instrument air system, safety-related air system and other relevant systems as applicable.

In its response dated October 13, 2009, the applicant stated that LRA Section 3.3.1.15 and LRA Table 3.3.2-15 for the applicant's AMR do not credit the Compressed Air Monitoring Program because this program is only identified in the GALL Report as managing the aging effects of compressed air system components subject to an AMR that have a condensation internal environment. The applicant stated that the Compressed Air Monitoring Program implements NRC GL 88-14 and Institute of Nuclear Power Operations (INPO Significant Operating Experience Report (SOER) 88-01 and applies to all compressed air systems even though not all compressed air components are included within the scope of license renewal. The applicant stated that its program indirectly manages the instrument air system and safety-related air system by monitoring air system parameters such as entrained particulates, dew points and oil concentration, and the preventive maintenance tasks and scheduled surveillances blowdown instrument and safety-related air system dead legs and safety-related receivers. The applicant further confirmed that the Compressed Air Monitoring Program manages the effects of aging for both the instrument air system and safety-related air system.

In its review of the applicant's response, the staff noted that the applicant does not credit the Compressed Air Monitoring Program in LRA Section 3.3.1.15 and LRA Table 3.3.2-15 for the instrument air system because the applicant's AMR is performed consistent with the AMR items in the GALL Report that recommend this program specifically for components exposed to a condensation (internal) environment. The staff also finds that the program applies to all compressed air systems so that the aging effects of the relevant components in the systems are managed consistent with the GALL Report. The staff noted that the applicant confirmed that the description in the UFSAR supplement is being clarified to indicate that the instrument air system and safety-related air system are both recognized as being age managed under license renewal as described above.

Based on its review, the staff finds the applicant's response to RAI B.3.16-1, acceptable because the applicant clarified that its program manages the aging effects of both instrument air system and safety-related air system, and revised the UFSAR supplement to state that the systems in the scope of the program are consistent with the GALL Report and SRP-LR Table 3.3-2. The staff's concern described in RAI B.3.16-1 is resolved.

LRA Section B.3.16.1 states that a semi-annual air system quality check is performed as part of the monitoring activities. During its audit, the staff noted that the applicant's program basis document included the applicant's surveillance test procedure (STP) regarding instrument air quality which includes air quality tests, such as oil concentration test, dew point test, and particulate size and concentration test. The staff also noted that the applicant's program basis document states that the plant auxiliary operator log records system and equipment parameters each shift, such as instrument air dew point and system pressure. However, the staff noted that the STP does not specify the test frequencies for the air quality tests, which were described in LRA Section B.3.16.1. By letter dated September 14, 2009, the staff issued RAI B.3.16-3 requesting that the applicant: (1) clarify how the frequencies of the air quality tests per the applicant's STP are specified and controlled, (2) clarify how the frequency of monitoring the dew point data is specified and controlled, and (3) confirm whether the frequency of the dew point monitoring is consistent with the recommendation of ISA-S7.0.01-1996, which is shift monitoring.

In its response dated October 13, 2009, the applicant clarified that the air quality tests are performed every six months and the test frequency is controlled by the pre-planned task (PPT) in the applicant's work maintenance database. The applicant also confirmed that dew point data are recorded per shift in accordance with the operations department instructions and the per-shift dew point monitoring is consistent with the recommendations of ISA-S7.0.01-1996.

Based on its review, the staff finds the applicant's response to RAI B.3.16-3, acceptable because the applicant clarified that the air quality test frequencies are controlled by the established maintenance database and PPT, and the dew point monitoring frequency is also adequately controlled and consistent with the recommendations of ISA-S7.0.01-1996, which are referenced in the GALL Report. The staff's concern described in RAI B.3.16-3 is resolved.

Based on its audit and review of the applicant's response to RAI B.3.16-1 and RAI B.3.16-3, the staff finds that elements one through six of the applicant's Compressed Air Monitoring Program are consistent with the corresponding program elements of GALL AMP XI.M24 and are, therefore, acceptable.

Operating Experience. LRA Section B.3.16 summarizes operating experience related to the Compressed Air Monitoring Program. The applicant stated that in several instances corrective action records show that the monitoring techniques of its program were effective in identifying declining performance and/or system degradation such as increased system air usage, dew point out of tolerance, and air leaks.

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

During its review, the staff identified operating experience which could indicate that the applicant's program may not be effective in adequately managing aging effects during the period of extended operation. The staff determined the need for additional clarification, which resulted in the issuance of the following RAI.

The staff noted that additional information to clarify whether the applicant's operating experience supports the claim that the Compressed Air Monitoring Program is adequate to manage the aging effects of the compressed air systems in relation to the following experience. LRA Section B.3.16.5 states:

> Corrosion products were found in the instrument air receiver tanks and in the accessible sections of the air receivers supply piping. Modifications included replacement of the carbon steel underground piping (in 2007) with stainless steel piping and the installation of blowdown piping on the Y-strainers associated with the instrument air receiver tanks to allow the Y-strainers to be cleared by blowing them down which allowed the downstream drain taps to perform their water removal function more reliably.

During its audit, the staff reviewed the applicant's program basis document and noted that corrective actions included a work order to take UT readings on the lower portion of an instrument air receiver tank (1T055A) to determine the amount of wall thinning due to internal corrosion. The staff noted the results of the bottom head is nominal wall thickness of 0.344 inches. The staff further noted the minimum wall thickness based on hoop stress is 0.224 inches and the four small areas indicate wall thickness of 0.224 inches down to 0.181 inches, 0.094 inches, 0.082 inches, and 0.077 inches. Furthermore, the staff noted that the applicant identified a need to evaluate for continued acceptance and/or repair.

In comparison, EPRI/Nuclear Maintenance Assistance Center (NMAC) NP-7079, "Instrument Air System," referenced by GALL AMP XI.M24, states that:

> In some systems air from the aftercooler enters a moisture separator for final water removal, thus protecting the receiver from moisture accumulation. The compressed air temperature at the outlet of the aftercooler may still be above the plant ambient temperature, in which case further cooling and condensation occurs in the air receiver. Plants without a moisture separator usually provide drain taps and receiver blowdown. Finally, the compressed air enters the receiver and acts as a storage tank and pressure surge buffer for the distribution system.

In its review, the staff is concerned that the wall thinning of the instrument air receiver tank due to internal corrosion can degrade the integrity of the air receiver tank and potentially affect the intended function of air-operated equipment by generating and releasing corrosion products to the air distribution system.

By letter dated September 14, 2009, the staff issued RAI B.3.16-4 requesting that the applicant: (1) describe how the wall thinning evaluation was performed for the four small areas, which indicated thickness values less than the minimum wall thickness based on hoop stress as described in the corrective action, and to describe what actions were taken to prevent and mitigate the wall thinning and internal corrosion of the air receiver tank; (2) clarify whether the instrument air system has moisture separators upstream of the instrument air receivers as addressed in EPRI NP-7079, Section 2.0; (3) describe how the program prevents or mitigates the wall thinning and internal corrosion of the air receiver tank and how the applicant's program prevents or mitigates the transport of corrosion products and contaminants from the air receiver tank and its upstream portions to the other downstream portions of the air distribution system; and (4) describe the operating experience in order to clarify whether the corrosion and wall thinning observed in the air receiver tank has adversely affected the performance or integrity of the air-operated equipment and components in its compressed air systems.

In its response dated October 13, 2009, the applicant clarified that the wall thinning evaluation was done as an ASME Section VIII calculation and the weld buildup of the bottom head was done using an ASME Section IX qualified procedure and ASME qualified welder with the examination of weld repair areas using VT and magnetic testing (MT) which were found acceptable. The applicant also confirmed that preventive maintenance activities were issued to perform UT measurements on the receiver tanks every 3 years to maintain their minimum wall thickness for continued operation and verify there is no excessive corrosion occurring.

Based on its review, the staff finds this portion of the applicant's response to RAI B.3.16-4, acceptable because: (1) the applicant's corrective action was adequate because the repair activities were performed in accordance with the qualified procedure of the ASME Code and the post-repair examination confirmed that the repair was acceptable, and (2) the corrective actions and maintenance activities using UT measurements are adequate to ensure that the wall thickness for the air receiver tank is maintained acceptable.

In its review of the LRA and the applicant's response, the staff also noted that the drain traps are installed in drain lines off the bottom of the air receiver tanks, and blowdown piping and valves are installed on the Y-strainers associated with the instrument air receiver tanks to allow the Y-strainers to be cleared by blowdown.

Based on its review, the staff finds this portion of the applicant's response to RAI B.3.16-4, acceptable because the maintenance activities that blowdown the piping and drain the drain traps are adequate to manage the aging effects and maintain the intended functions of the components because the activities can remove corrosion products that can adversely affect the performance of air-operated equipment and mitigate the development of a corrosive condensate environment by removing moisture from the compressed air systems.

In its response, the applicant also stated that the SOER Effectiveness Review report dated March 3, 2010, confirmed that no failures of point-of-use components have been observed due to poor air quality in the instrument air system. The applicant further confirmed that the Instrument Air System Health Report states that no instrument air transients resulted in a balance of plant isolation since 1993.

Based on its review, the staff finds this portion of the applicant's response to RAI B.3.16-4, acceptable because the review results of operating experience indicate that the Compressed Air Monitoring Program with the applicant's corrective actions has been effective and adequate to manage the aging effects.

Based on its review, the staff finds the applicant's response to RAI B.3.16-4, in its entirety, acceptable as described above. The staff's concern described in RAI B.3.16-4 is resolved.

Based on its audit and review of the application, and review of the applicant's response to RAI B.3.16-4, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

<u>UFSAR Supplement</u>. LRA Section 18.1.16 provides the UFSAR supplement for the Compressed Air Monitoring Program. The staff reviewed this UFSAR supplement description of the program against the recommended description for this type of program as described in SRP-LR Tables 3.3-2. The staff required clarification as to whether the applicant's UFSAR Supplement for this program is consistent with the UFSAR supplement summary described in SRP-LR Table 3.3-2 in the following areas because the applicant's UFSAR supplement did not clearly indicate: (1) whether the program performs inspection, monitoring, and testing of the entire system including frequent leakage testing valves, piping, and other system components, especially those made of steel, (2) whether the program is in response to NRC GL 88-14 and INPO's SOER 88-01, and (3) whether the description "instrument air system" in the UFSAR supplement needs to be changed to the "compressed air systems" or relevant terminology for system description in such a way to encompass the instrument air system, safety-related air system, and other relevant systems as applicable.

By letter dated September 14, 2009, the staff issued RAI B.3.16-2 requesting the applicant describe how, if applicable, the UFSAR supplement for the Compressed Air Monitoring Program will be revised to resolve the potential discrepancies between the UFSAR supplement described in SRP-LR Table 3.3-2 and the applicant's UFSAR supplement as described above.

In its response dated October 13, 2009, the applicant clarified that leak testing is performed for valves, piping, and other system components, especially those made of steel and stainless steel, and its program is in response to NRC GL 88-14 and INPO SOER 88-01. The applicant also revised the UFSAR supplement in such a way to clarify the conduct of leak testing and the program basis documents in the UFSAR supplement. The applicant also confirmed that in the UFSAR supplement the system description terminology is revised from "instrument air system" to "compressed air systems" including the safety-related air, instrument air, service air, and breathing air systems.

Based on its review, the staff finds the applicant's response to RAI B.3.16-2, acceptable because the revised UFSAR supplement provides an acceptable UFSAR supplement summary description of the applicant's program consistent with SRP-LR Table 3.3-2. The staff's concern described in RAI B.3.16-2 is resolved.

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

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

3.0.3.1.15 Electrical Cables and Connections Program

Summary of Technical Information in the Application. LRA Section B.3.17 describes the new Electrical Cables and Connections Program as consistent with GALL AMP XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." The applicant stated that its program manages the effects of aging due to radiological, thermal, and moisture aging mechanisms.

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

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.E1. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.E1. Based on its audit, the staff finds that elements one through six of the applicant's Electrical Cables and Connections Program, are consistent with the corresponding program elements of GALL AMP XI.E1 and, therefore, acceptable.

Operating Experience. LRA Section B.3.17 summarizes operating experience related to the Electrical Cables and Connections Program. The applicant stated its program is a new program; therefore, there is no plant-specific program operating experience for program effectiveness. The applicant also stated that industry operating experience that forms the basis for the program is described in the operating experience element of the GALL AMP XI.E1 program description. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program. As additional operating experience is obtained, the applicant will incorporate lessons learned into the program. The applicant further stated that past inspections and monitoring activities have revealed embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength. The issues were addressed and documented using the corrective action program.

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

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

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

UFSAR Supplement. LRA Section A18.1.17 provides the UFSAR supplement for the Electrical Cables and Connections Program. The staff reviewed this USFAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.6-2.

The staff also notes that the applicant committed (Commitment No. 4) to implement the new Electrical Cables and Connections Program prior to entering the period of extended operation for managing aging of applicable components.

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

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

3.0.3.1.16 Electrical Cables and Connections Used In Instrumentation Circuits Program

Summary of Technical Information in the Application. LRA Section B.3.18 describes the new Electrical Cables and Connections Used in Instrumentation Circuits Program as consistent with GALL AMP XI.E2, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits." The applicant stated that the program manages the effects of aging due to radiological and thermal aging mechanisms that affect the insulation resistance (IR) of cables and connections used in instrumentation circuits.

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

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.E2. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.E2, with the exception of the "scope of the program" program element. For this element, the staff required additional clarification which resulted in the issuance of an RAI.

The "scope of the program" program element of GALL AMP XI.E2 states that this program applies to electrical cable and connections used in circuits with sensitive, high-voltage, low-level signals such as radiation monitoring and nuclear instrumentation that are subject to an AMR. In the applicant's program basis document for the "scope of the program" program element, it states that the in-scope cables are in the nuclear instrumentation system and there are no radiation monitoring system cables in the scope of this program. The staff noted that the radiation monitoring system cables are within the scope of license renewal because it performs an intended function to prevent or mitigate the consequences of accident which could result in potential offsite exposure. The staff further notes these cables are used in sensitive, high-voltage, low level signal circuits and that exposure of these electrical cables to heat, radiation, or moisture can result in reduced IR. Reduced IR can cause an increase in leakage current between conductors and from individual conductors to ground. Furthermore, a reduction in IR is a concern for circuits with sensitive, high-voltage, low-level signals such as high-range radiation monitoring system cables. By letter dated September 14, 2009, the staff issued RAI B.3.18-1 requesting that the applicant explain why the radiation monitoring system circuits are not included in the scope of this program.

In its response dated October 13, 2009, the applicant stated that instrumentation cables for radiation monitoring systems are not in the scope of the Electrical Cables and Connections Used in Instrumentation Circuits Program because either they are included in the 10 CFR 50.49 EQ Program, or they are not located in adverse localized environments. The applicant also stated that it defines adverse localized environments for instrumentation cable as areas with a radiation dose greater than 3×10^7 rads and/or temperature greater than 60 °C (140 °F). The applicant further stated the radiation monitoring system instrumentation cables that are not included in the EQ Program are in areas where the maximum design dose is 5.3×10^4 rads and maximum design temperature is 40 °C (104 °F). Furthermore, the radiation monitoring system instrumentation cables are designed and qualified for this environment.

The staff questioned the applicant's response to RAI B.3.18-1. The high-range radiation monitors monitor radiation levels of specified liquid systems, gaseous systems, and general areas throughout the plant; assist in controlling the release of radioactive materials, and provide personnel safety by warning of abnormal radiation levels. These monitors are typically installed in an adverse localized environment due to high heat, radiation, or moisture. GALL AMP XI.E2, under the "scope of the program" program element states that this program applies to electrical cable and connections used in circuits with sensitive, high-voltage, low-level signals such as radiation monitoring and nuclear instrumentation that are subject to an AMR. The scope of the applicant's Electrical Cables and Connections Used in Instrumentation Circuits Program is not consistent with GALL AMP XI.E2. The staff requested that the applicant provide additional technical justification as to why radiation monitors are not required to be in-scope of the Electrical Cables and Connections Used in Instrumentation Circuits Program.

In response to the staff's request, in a letter dated March 9, 2010, the applicant stated that the issue is not a question of consistency with GALL AMP XI.E2 but a question concerning the scoping and screening process. The applicant also stated the radiation monitors that the staff is questioning are not within the scope of license renewal and, therefore, are not within the scope of the Electrical Cables and Connections Used in Instrumentation Circuits Program. The applicant further stated that DAEC does not consider the area radiation monitor system, environmental radiation monitor system, liquid process radiation monitor system, low level radwaste processing and storage facility Kaman radiation monitor system, stack gas Kaman radiator monitor system, off-gas radiation monitor system, reactor building Kaman radiation monitor system, and turbine building Kaman radiation monitor system to meet the scoping criteria listed in 10 CFR 54.4(a)(1) – (3) based on the following:

- These systems are not relied upon to remain functional during and following design-basis events (as defined in 10 CFR 50.49(b)(1)) to maintain the integrity of the reactor coolant pressure boundary; aid in the capability to shut down the reactor and maintain it in a safe shutdown condition; or aid in the capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to those referred to in 10 CFR 50, 50.34(a)(1), 50.67(b)(2), or 100.11, as applicable.

- No electrical failure in these systems could prevent satisfactory accomplishment of safety-related functions.

- None of these systems are relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with NRC regulations for fire protection, environmental qualification, pressurized thermal shock, anticipated transients without scram, and station blackout.

Table 1 below lists the functions for these systems as described in LRA Table 2.2-2 as revised by applicant letter NG-09-0823, dated December 2, 2009.

Table 1

System	Function
Area Radiation Monitor System	Notifies personnel of airborne radiation hazards
Environmental Radiation Monitor System	Provides integrated measurements of direct radiation exposure at the boundary of the unrestricted area to confirm that the operation of the plant is in accordance with the requirements of 10 CFR Part 20
Low Level Radwaste Processing and Storage Facility (LLRWSF) Kaman Radiation Monitor System	Provides a clear indication whenever abnormal amounts of radioactivity exist in the LLRWSF facility and prompts operator action
Stack Gas Kaman Radiation Monitor System	Provides a clear indication whenever limits on the release of radioactive material to the environment are reached or exceeded
Off-Gas Radiation Monitor System	Provides an alarm to operations personnel when radioactivity exists in the reactor building main exhaust stacks and prompts operator actions
Reactor Building Kaman Radiation Monitor System	Provides a clear indication whenever abnormal amounts of radioactivity exist in the reactor building main exhaust stacks and prompts operator actions
Turbine Building Kaman Radiation Monitor System	Provides a clear indication whenever abnormal amounts of radioactivity exist in the turbine building ventilation roof vents and prompts operator actions

The applicant stated that the radiation monitoring systems originally in the scope of license renewal, but having cables that are not in the scope of the Electrical Cables and Connections Used in Instrumentation Circuits Program, are the drywell radiation monitor, main steam supply line radiation monitor, control building ventilation radiation monitor, and the reactor building ventilation radiation monitor.

The applicant further stated that:

- The drywell radiation monitors and associated cables are in the Environmental Qualification (EQ) Program. This includes the entire length of cables from the detector to the control room panel. Therefore, these cables are not in the scope of the Electrical Cables and Connections Used in Instrumentation Circuits Program.

- The safety function of the main steam supply line radiation monitor was deleted per NRC-approved License Amendment 261 (ML063100647) and the system has been removed from the scope of license renewal. DAEC UFSAR Section 11.5.1 contains details on why the safety function was removed. Therefore, these cables are not in the scope of the Electrical Cables and Connections Used in Instrumentation Circuits Program.

- The control building ventilation radiation monitor, the reactor building ventilation radiation monitor, and associated cables are in mild environments (temperature between 68 °C and 104 °F, 60-year normal total dose less than or equal to 5.3 x 10^4 Rads). These cables are not exposed (over any part of the length) to adverse localized environments (heat, radiation, or moisture). Also, these cables were installed new in 2005 when the analog system was replaced with a digital system. Therefore, these cables are not in the scope of the Electrical Cables and Connections Used in Instrumentation Circuits Program.

The applicant also stated that when DAEC defined the scope of the Electrical Cables and Connections Used in Instrumentation Circuits Program, the engineers obtained a list of the coaxial and triaxial cables from the controlled cables and raceway database. This database lists all cables that are in raceways (conduit and cable trays). Cables in systems that are not in the scope of license renewal were identified as not having a license renewal function. Cables in the EQ program were identified as having a license renewal function but aging management was covered by the EQ program. The cables that were left installed in an adverse localized environment were included in the Electrical Cables and Connections Used in Instrumentation Circuits Program. Therefore, the applicant concluded that the only cables in the program are for the neutron monitoring systems (intermediate power range monitor and the power range monitor systems).

The staff reviewed the applicant’s response and finds its acceptable. The area radiation monitor system, environmental radiation monitor system, liquid process radiation monitor system, LLRWSF Kaman radiation monitor system, stack gas Kaman radiation monitor system, reactor building Kaman radiation monitor system, and turbine building Kaman radiation monitor system provide indication. They do not meet the scoping criteria listed in 10 CFR 54.4(a)(1) to (3). The Drywell Radiation Monitors and associated cables are in the EQ Program. Therefore, these cables are not required to be included in the Electrical Cables and Connections Used in Instrumentation Circuits Program. The safety function of the main steam line radiation monitor system was deleted per staff-approved License Amendment 261. This system no longer provides the capability to prevent or mitigate the consequence of accidents which could result in potential offsite exposures. For the remaining radiation monitor systems (control building ventilation radiation monitor and the reactor building ventilation radiation monitor), the entire length of cables for these systems are not located in an adverse localized environments (high heat, radiation, or moisture). Therefore, these cables are not required to be included in the scope of the Electrical Cables and Connections Used in Instrumentation Circuits Program. The only cables in the program are for the neutron monitoring system cables. The staff’s concern in the followup to the applicant’s response to RAI B.3.18-1 is resolved.

Based on its audit, the staff finds that elements one through six of the applicant’s Electrical Cables and Connections Used in Instrumentation Circuits Program are consistent with the corresponding program elements of GALL AMP XI.E2 and, therefore, acceptable.

Operating Experience. LRA Section B.3.18 summarizes operating experience related to the Electrical Cable and Connections Used In Instrumentation Circuits Program. The applicant stated that its program is a new program; therefore, there is no plant-specific program operating experience for the program. Industry operating experience that forms the basis for the program is described in the operating experience element of the NUREG-1801 program description. The applicant also stated that industry and plant-specific operating experience will be evaluated in the development and implementation of this program. As additional operating experience is obtained, lessons learned will be appropriately incorporated into the program. The applicant further stated that it has been performing IR testing or time domain reflectometry on neutron monitoring system cables during RFOs and no cable degradation has been identified either by testing or as a result of inservice failure.

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

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

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

UFSAR Supplement. LRA Section 18.1.18 provides the UFSAR supplement for the Electrical Cables and Connections Used In Instrumentation Circuits Program. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.6-2.

The staff also notes that the applicant committed (Commitment No. 5) to implement the new Electrical Cables and Connections Used In Instrumentation Circuits Program prior to entering the period of extended operation for managing aging of applicable components.

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

Conclusion. On the basis of its review of the applicant's Electrical Cables and Connections Used in Instrumentation Circuits Program, the staff finds 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, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.17 Flow-Accelerated Corrosion Program

Summary of Technical Information in the Application. LRA Section B.3.24 describes the existing Flow-Accelerated Corrosion Program as consistent with GALL AMP XI.M17, "Flow-Accelerated Corrosion." The applicant stated that the program manages the aging effect of loss of material due to flow-accelerated corrosion on the internal surfaces of all carbon and low-alloy piping and components containing high energy fluids. In addition, the applicant stated that the program is based on the guidelines of Nuclear Safety Analysis Center (NSAC)-202L, "Recommendations for an Effective Flow Accelerated Corrosion Program," uses CHECWORKS as a predictive tool to determine susceptible locations and performs initial baseline inspections with followup inspections to confirm predictions, and repairs or replaces components, as necessary.

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

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M17. As discussed in the Audit Report, the staff confirmed that each of these elements is consistent with the corresponding element of GALL AMP XI.M17, with the exception of the "scope of the program" and "detection of aging effects" program elements. For these elements, the staff determined the need for additional clarification which resulted in the issuance of an RAI.

The staff noted that the applicant's operating experience database states that erosion had occurred on some components, and that the applicant's program basis document indicates that the program is used to manage the loss of material due to both flow-accelerated corrosion and erosion. However, the staff noted that the guidance in NSAC-202L specifically states that the degradation mechanism of erosion is not part of a flow-accelerated corrosion program and should be evaluated separately. The staff noted that the applicant's program basis document did not address erosion in any of the 10 program elements and, therefore, additional information was required for the staff to complete its review. By letter dated September 14, 2009, the staff issued RAI B.3.24-1 requesting that the applicant clarify the information in the LRA by indicating that the Flow-Accelerated Corrosion Program will also manage the aging effect "loss of material due to erosion," and to discuss any consequent changes to the program elements in the associated program basis document.

In its response dated October 13, 2009, the applicant stated that the program basis document was being revised to specifically indicate that the program includes followup activities for identified erosion. However, the staff noted that the applicant provided no further information regarding changes to any of the program elements for this AMP, as requested in the RAI. In a phone conversation on January 22, 2010, the staff discussed with the applicant the need for additional information in order for the staff to complete its review. The applicant agreed to provide this additional information to the staff, and in its response dated February 2, 2010, provided a revised review of the 10 program elements associated with the Flow-Accelerated Corrosion Program. The applicant discussed various aspects of the aging effect for material loss due to erosion in the "scope of the program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "operating experience" program elements. The applicant stated that there are no predictive tools for determining locations for erosion and inspection locations are selected based on operating experience. The applicant also stated that these locations are inspected using the same techniques as those used for measuring wall thinning due to flow-accelerated corrosion, and the inspection results are trended and corrective actions are initiated prior to loss of intended function. Based on its review, the staff finds the applicant's response, dated February 2, 2010, acceptable because it provided sufficient information concerning the program's implementation relating to loss of material due to erosion. The staffs concern described in RAI B.3.24-1 is resolved.

In a letter dated January 14, 2010, the applicant provided additional changes and clarifications to the Flow-Accelerated Corrosion Program. In Enclosure 1 of the letter, the applicant stated that it implements the guidance provided in EPRI NSAC-202L, Revision 3, "Recommendations for an Effective Flow-Accelerated Corrosion Program," May 2006, in lieu of the GALL Report's recommendation of EPRI NSAC-202L, Revision 2. The applicant further stated that EPRI NSAC-202L, Revision 3 is the most recent revision of this document and that it refines and enhances the recommendations of the earlier versions, without contradiction, to ensure continuity of the existing plant flow-accelerated corrosion program. The staff agreed with the applicant that EPRI NSAC-202L, Revision 3 refines and enhances recommendations of earlier versions without contradiction. The staff also noted that a pending revision to the GALL Report will recommend the use of either Revision 2 or Revision 3 of EPRI NSAC-202L. As a result, the staff finds that the use of EPRI NSAC-202L, Revision 3 is acceptable.

Based on its audit and review of the applicant's responses to RAI B.3.24-1, and the additional information provided on January 14, 2010, and February 2, 2010, the staff finds that program elements one through six of the applicant's Flow-Accelerated Corrosion Program, with an acceptable exception, are consistent with the corresponding program elements of GALL AMP XI.M17 and, therefore, acceptable.

Operating Experience. LRA Section B.3.24.5 summarizes operating experience related to the Flow-Accelerated Corrosion Program. The applicant stated that the Flow-Accelerated Corrosion Program has "verified that actual wear was less than or equal to predicted wear." The staff noted that the applicant's inspection results from the RFO in 2007 had identified multiple areas where the measured wear rate was significantly higher than predicted wear rate. The applicant's 2007 Outage Summary Report acknowledged the variation between predicted and measured wear rates, and stated that caution should be used in determining the accuracy of the model predictions, since the measured wear rate may be inflated due to manufacturing variations for certain components. By letter dated September 14, 2009, the staff issued RAI B.3.24-2 and requested that the applicant clarify the discrepancy between the information available onsite and the information provided in the LRA.

In its response dated October 13, 2009, the applicant indicated that the statement in the LRA was incorrect, and that LRA Section B.3.24.5 was being revised to state that the Flow-Accelerated Corrosion Program "verified actual wear measurements against predicted wear values."

Based on its review, the staff finds the applicant's response to RAI B.3.24-2 acceptable because it corrected the discrepant information in the LRA. The staffs concern described in RAI B.3.24-2 is resolved.

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

During its review, the staff found no operating experience to indicate that the applicant's program would not be effective in adequately managing aging effects during the period of extended operation. However, as discussed above, the applicant indicated that erosion had occurred on some components, and the applicant chose to manage the loss of material due to erosion through the Flow-Accelerated Corrosion Program. Also as noted above, in its response to RAI B.3.24-1, the applicant initially did not provide a discussion concerning erosion in any of the program elements, which included "operating experience."

Based on additional discussions with the staff, the applicant provided operating experience in its response dated February 2, 2010. The applicant's information discussed the inspection of test return lines for the residual heat removal and core spray systems, based on the discovery of wall thinning in these lines at Monticello in 2003. According to the applicant, portions of these lines were replaced because of the loss of material, and operating times for these lines were being tracked to ensure the average yearly usage was not exceeded. In addition, the staff noted that portions of the reactor lower head drain were inspected during RFO 20, based on EPRI 1013013, “An Evaluation of Flow-Accelerated Corrosion in the Bottom Head Drain Lines of Boiling Water Reactors.” The staff considered these as a clear indication that operating experience from outside sources was being incorporated in the applicant’s Flow-Accelerated Corrosion Program.

Based on its audit and review of the application, review of the applicant’s response to RAI B.3.24-2, and information provided in the response dated February 2, 2010, the staff finds that operating experience related to the applicant’s program demonstrated that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the “operating experience” program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

<u>UFSAR Supplement</u>. LRA Section A.18.1.24, as revised by letter dated January 14, 2010, provides the UFSAR supplement for the Flow-Accelerated Corrosion Program.

The staff reviewed this UFSAR supplement description of the program and noted that it did not conform to the recommended description for this type of program as described in SRP-LR Tables 3.2-2 and 3.4-2. The staff noted that the UFSAR supplement description included the statement that the program included performance of limited baseline inspections. By letter dated September 14, 2009, the staff issued RAI B.3.24-3 requesting that the applicant clarify its statement in the LRA regarding the program’s performance of “limited baseline inspections.”

In its response dated October 13, 2009, the applicant stated that the word “limited” would be deleted from the LRA.

Based on its review, the staff finds the applicant’s response to RAI B.3.24-3 acceptable because the revised statement does not indicate any limitations on the applicant’s baseline inspections. The staff’s concern described in RAI B.3.24-4 is resolved.

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

<u>Conclusion</u>. On the basis of its audit and review of the applicant’s Flow-Accelerated Corrosion Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program as required by 10 CFR 54.21(d).

3.0.3.1.18 Fuse Holders Program

Summary of Technical Information in the Application. LRA Section B.3.26 describes the new Fuse Holders Program as consistent with GALL AMP XI.E5, "Fuse Holders." The applicant stated that its program manages the effects of aging caused by loosening of the metal clip (fatigue) and ohmic heating due to frequent manipulation. The applicant also stated that the program includes fuse holders that support a license renewal function and are not part of an active component. The applicant further stated that the program manages aging by thermographic inspection to identify aging due to loosening of the metal clip. The applicant concluded that the Fuse Holders Program provides reasonable assurance that the effects of aging will be managed such that the applicable components will continue to perform their intended functions consistent with the CLB for the period of extended operation.

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

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.E5. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.E5, with the exception of the "parameters monitored or inspected" program element. For this element, the staff required additional clarification which resulted in the issuance of an RAI.

The "parameters monitored or inspected" program element of GALL AMP XI.E5 states that the monitoring includes thermal fatigue in the form of high resistance caused by ohmic heating, thermal cycling, or electrical transients; mechanical fatigue caused by frequent removal/replacement of the fuse or vibration; chemical contamination; corrosion; and oxidation. During its audit, the staff noted that the applicant's AMR report contains the following information: "Section 2.4, 'operating environments and exposures,' Item 2.4.1, 'environmental conditions,'" states that all fuse holders are located inside a cabinet, panel, or other electrical enclosure to protect the fuse holder from moisture. Item 2.4.1 also states that fuse holders will be exposed to ambient temperature conditions inside the electrical enclosure. However, Section 5.1 states that fuse holders are protected by their location within a controlled environment.

By letter dated September 14, 2009, the staff issued RAI B.3.26-3 requesting the applicant to clarify why there is a difference between identified fuse holder environmental conditions within the AMR report.

In its response dated October 13, 2009, the applicant stated that there was no intent to have two different environments. The applicant stated that the sentence, "Fuse holders are protected by their location within a controlled environment," has been deleted from the report.

Based on its review, the staff finds the applicant's response to RAI B.3.26-3 acceptable because the applicant revised the basis document and clarified the fuse holder environment referenced in the basis document. The staff's concern described in RAI B.3.26-3 is resolved.

GALL AMP XI.E5 states that the fuse holder AMP needs to account for the following aging stressors, if applicable: fatigue, mechanical stress, vibration, chemical contamination, and corrosion. The "parameters monitored or inspected" program element of GALL AMP XI.E5 states that the monitoring includes thermal fatigue in the form of high resistance caused by ohmic heating, thermal cycling, or electrical transients; mechanical fatigue caused by frequent removal/replacement of the fuse or vibration; chemical contamination; corrosion; and oxidation. LRA Section B.3.26 does not discuss why some of the aging stressors identified in GALL XI.E5 are not applicable.

By letter dated September 14, 2009, the staff issued RAI B.3.26-2 requesting that the applicant explain why additional aging stressors indentified by GALL AMP XI.E5 are not applicable.

In its response dated October 13, 2009, the applicant stated that LRA Section B.3.26.2 will be revised to state that the program is consistent with the nine elements of GALL XI.E5 with an exception taken to the “parameters monitored or inspected” program element.

Based on its review, the staff finds the applicant’s response to RAI B.3.26-2 acceptable because the applicant amended its LRA to identify an exception to the “parameters monitored or inspected” program element. The staff’s review of this newly identified exception and its acceptability is discussed below. The staff’s concern described in RAI B.3.26-2 is resolved.

The staff also reviewed the portions of the “parameters monitored or inspected” program element associated with the exception, as amended by letter dated October 13, 2009, to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff’s evaluation of these exceptions follows.

Exception. LRA Section B.3.26 states an exception was taken to the “parameters monitored or inspected” program element, as amended by letter dated October 13, 2009.

The applicant stated that LRA Section B.3.26 takes exception to the following aging mechanisms listed in GALL AMP XI.E5: electrical transients, vibration, chemical contamination, corrosion, and oxidation. The applicant stated that only significant electrical faults could cause fatigue and these would not be considered an aging mechanism. The applicant also stated that electrical enclosures are installed to minimize fuse holder vibration and corrosion (moisture, chemical and oxidation). The applicant further stated that the location of fuse holders was reviewed to identify fuse holders installed outside of an active device, junction box, or similar enclosure (i.e., unprotected environment). The applicant confirmed that the review identified no unprotected fuses. The applicant evaluated the aging mechanisms and provided an adequate basis for not including these aging mechanisms in the applicant’s Fuse Holders Program. The applicant is to revise LRA Sections B.3.26.2 and B.3.26.3; LRA Table 3.6.2, “Summary of Aging Management Review Results Electrical and Instrumentation Commodity Groups;” LRA Appendix A, Section 18.1.26, “Fuse Holders Program;” and LRA Table B.2.2-1, as referenced in the applicant’s RAI response dated October 13, 2009. These revisions will incorporate the applicant’s aging mechanism exceptions into the LRA.

Based on its review, the staff finds this exception acceptable because the applicant provided adequate justification for not including the specific aging mechanisms as described above and revised LRA Sections B.3.26.2 and B.3.26.3; LRA Table 3.6.2, “Summary of Aging Management Review Results Electrical and Instrumentation Commodity Groups;” LRA Appendix A, Section 18.1.26, “Fuse Holders Program;” and LRA Table B.2.2-1 to reflect the aging mechanism exceptions taken by the applicant.

Based on its audit and review of the applicant’s responses to RAIs B.3.26-2 and B.3.26-3, the staff finds that elements one through six of the applicant’s Fuse Holders Program, with acceptable exceptions, are consistent with the corresponding program elements of GALL AMP XI.E5 and, therefore, acceptable.

Operating Experience. LRA Section B.3.26 summarizes operating experience related to the Fuse Holders Program. The applicant stated that its program is a new program; therefore, there is no plant-specific operating experience for determining program effectiveness. The applicant also stated that industry operating experience that forms the basis for the program is described in the operating experience element of the NUREG-1801 program description. The applicant further stated that industry and plant-specific operating experience will be evaluated in the development and implementation of this program. The applicant's basis document and LRA Section B.3.26 state that past inspections/monitoring activities have not revealed loosening of the metal clip due to fatigue and ohmic heating due to frequent manipulation. The applicant's basis document states that the Fuse Holders Program will periodically test fuse holders within the scope of license renewal for increased contact resistance at least once every 10 years.

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

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

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

UFSAR Supplement. LRA Section 18.1.26 provides the UFSAR supplement for the Fuse Holders Program. The staff reviewed this UFSAR supplement description of the program against the recommended description for this type of program as described in SRP-LR Table 3.6-2.

The staff noted that SRP-LR Table 3.6.2, "FSAR Supplement for Aging Management of Electrical and Instrumentation and Control System," states that fuse holders within the scope of license renewal will be tested at least once every 10 years and the first test for license renewal should be completed before the period of extended operation. LRA Section B.3.26 states that the program is consistent with GALL AMP XI.E5. The staff noted that Commitment No. 18 specifies only the establishment of the Fuse Holders Program prior to the period of extended operation and LRA Section 18.1.26 does not include a frequency of inspection (at least once every 10 years). The staff noted Commitment No. 18 and LRA Section 18.1.26 are not consistent with SRP-LR Table 3.6-2.

By letter dated September 14, 2009, the staff issued RAI B.3.26-1 requesting the applicant to provide a discussion as to why LRA Section 18.1.26 and Commitment No. 18 do not need to be consistent with SRP-LR Table 3.6.2 with regard to inspection frequency and implementation.

In its response dated October 13, 2009, the applicant inserted the following into LRA Section 18.1.26, “Fuse holders within the scope of license renewal will be inspected at least once every 10 years. The first inspection is to be completed before the period of extended operation.”

The applicant also revised Commitment No. 18 to reflect the above change as follows, “Implement a Fuse Holders Program and complete the first test prior to the period of extended operation.”

Based on its review, the staff finds the applicant’s response to RAI B.3.26-1 acceptable because the applicant revised LRA Sections 18.1.26 and Commitment No. 18, to include the inspection frequency commitment such that the UFSAR summary description and commitment are now consistent with SRP-LR Table 3.6.2. The staff’s concern described in RAI B.3.26-1 is resolved.

The staff also notes that the applicant committed (Commitment No. 18), as amended by letter dated October 13, 2009, to implement the new Fuse Holders Program prior to entering the period of extended operation for managing aging of applicable components.

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

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

3.0.3.1.19 Inaccessible Medium-Voltage Cables Program

Summary of Technical Information in the Application. LRA Section B.3.27 describes the applicant’s proposed program for Inaccessible Medium-Voltage Cables Program as consistent with GALL AMP XI.E3, “Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.” The applicant stated that the program manages the effects of aging due to moisture and voltage of medium-voltage cables that support a license renewal intended function, are susceptible to submergence, and are energized for a significant portion of their life. The applicant also stated that the program manages the effects of aging by periodically testing the insulation resistance of the cables, and also includes actions to prevent cables from being exposed to significant moisture by periodically inspecting the manholes and testing of sump pumps.

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

The staff compared elements one through six of the applicant’s program to the corresponding elements of GALL AMP XI.E3. As discussed in the Audit Report, the staff confirmed that each element of the applicant’s program is consistent with the corresponding element of GALL AMP XI.E3, with the exception of the “scope of the program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” and “acceptance criteria” program elements. For these elements, the staff required additional clarification which resulted in the issuance of RAIs.

The “scope of the program” program element of GALL AMP XI.E3 defines significant moisture as periodic exposure to moisture that lasts less than a few days (e.g., cable in standing water). Therefore, periodic exposure to moisture that lasts less than a few days (i.e., normal rain and drain) is not significant. The applicant’s aging management report stated that one of the conditions needed for water treeing to occur is the presence of continuous (long term) moisture. LRA Section B.3.27 stated that the program includes medium-voltage cables that support a license renewal function, are subject to submergence, and are energized for a significant portion of their life. The staff noted that the time frame for significant moisture, long term moisture, or submergence is not defined in the LRA or the associated program basis document.

By letter dated September 14, 2009, the staff issued RAI B.3.27-3 requesting the applicant to explain how the Inaccessible Medium-Voltage Cables Program is consistent, as stated in LRA Section B.3.27, with the definition of significant moisture as defined in the GALL AMP XI.E3 “scope of the program” program element.

In its response dated October 13, 2009, the applicant stated that the program basis document description of “scope of the program” has been revised to replace the term “long term moisture” with the term “significant moisture,” consistent with GALL AMP XI.E3. The applicant stated that the program description in LRA Section B.3.27 is revised to read as follows, “The program includes medium voltage cables that support a license renewal intended function, are susceptible to significant moisture as defined in NUREG-1801 XI.E3, and are energized a significant portion of their life.”

Based on its review, the staff finds the applicant’s response to RAI B.3.27-3 acceptable because the applicant revised the LRA and its program basis document to reflect the definition of significant moisture consistent with GALL AMP XI.E3. The staff’s concern described in RAI B.3.27-3 is resolved.

During its review of the “scope of the program” program element of GALL AMP XI.E3, the staff also noted that the scope of the applicant’s program did not include cable X00403-D, even though this cable was listed in the applicant’s basis document as a medium-voltage (i.e., having a license renewal function, being energized more than 25 percent of the time, and routed in an embedded/duct bank) and meets the conditions for being included in scoping of the program. Therefore, by letter dated September 14, 2009, the staff issued RAI B.3.27-4 requesting that the applicant provide a discussion, including manufacturer’s documentation, that cable X00403-D is designed for submerged service, in order to justify its exclusion from the scope of the program.

In its response dated October 13, 2009, the applicant stated that its record system does not contain any records of cable X00403-D since it was installed as part of the switchyard and not as part of the power plant. The applicant further stated neither the manufacturer’s name nor part number is visible on the exposed length of cable and as a result, manufacturer’s documentation is not available. Based on this information, the applicant added cable X00403-D to the scope of its program.

Based on its review, the staff finds the applicant’s response to RAI B.3.27-4 acceptable because the applicant included cable X00403-D in the scope of its program, consistent with GALL AMP XI.E3. The staff’s concern described in RAI B.3.27-4 is resolved.

The “preventive actions” program element of GALL AMP XI.E3 states that periodic actions are taken to prevent cables from being exposed to significant moisture, such as inspecting for water collection in cable manholes and draining water, as needed. The applicant’s program basis document states that its program consists of periodically inspecting the manholes for moisture and ensuring that the sump pumps in the manholes are operational. The program basis document further states that the sump pumps will drain the water as necessary and the sump pumps will keep the water below the level of the cables during normal seasonal conditions. From the staff review of provided duct bank documentation and selected walkdowns, the staff could not determine that all manholes associated with GALL AMP XI.E3 are equipped with sump pumps and associated alarms.

By letter dated September 14, 2009, the staff issued RAI B.3.27-1 requesting the applicant provide a discussion that confirms that the preventive actions, as stated in the applicant’s program basis document, are consistent with the GALL AMP XI.E3 “preventive actions” program element.

In its response dated October 13, 2009, the applicant stated that the program basis document has been clarified to read:

> The DAEC program consists of periodically inspecting the manhole for moisture. The periodic inspection will be either an inspection of the manhole for water or verifying operation of the sump pump (for those manholes with sump pumps installed). Table 7.3 lists the manholes with sump pumps installed.

Based on its review, the staff finds the applicant’s response to RAI B.3.27-1 acceptable because the applicant clarified in the program basis document that the program will also require inspections of manholes not equipped with sump pumps, which is consistent with the “preventive actions” program element of GALL AMP XI.E3. The staff’s concern described in RAI B.3.27-1 is resolved.

The “parameters monitored or inspected” program element of GALL AMP XI.E3 states that the specific type of test is to be a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, or polarization index, as described in EPRI TR-103834-P1-2, or other testing that is state of the art at the time the test is performed. The applicant’s program basis document states that the testing methodology currently used is a resistance test (megger). The staff noted that the “acceptance criteria” program element of the applicant’s program is also based on the above specified testing.

By letter dated September 14, 2009, the staff issued RAI B.3.27-2 requesting how the “parameters monitored or inspected” and “acceptance criteria” program elements, as described in its program basis document, are consistent with the associated program elements of GALL AMP XI.E3.

In its response dated October 13, 2009, the applicant stated that the program basis document has been revised to incorporate the following, “The commercially available test methods will be reviewed prior to performing each test to see if a better test exists. The best commercially available test method will be used.”

In addition, the program basis document is revised to state, “Acceptance criteria will be defined in the applicable maintenance procedure for the test.”

Based on its review, the staff finds the applicant's response to RAI B.3.27-2 acceptable because the applicant revised the program basis document to be consistent with the "parameters monitored or inspected" and "acceptance criteria" program elements of GALL AMP XI.E3, in that the applicant's program allows for alternate proven test methods to be evaluated and employed, as applicable. The staff's concern described in RAI B.3.27-2 is resolved.

The "detection of aging effects" program element of GALL AMP XI.E3 states that the first tests for license renewal are to be completed before the period of extended operation. GALL AMP XI.E3 also states that the first inspection for license renewal is to be completed before the period of extended operation. The applicant's program basis document states that this is an existing testing activity and, therefore, the first tests have already been performed.

By letter dated September 14, 2009, the staff issued RAI B.3.27-5 requesting an explanation as to how the basis document schedule meets the implementation schedule for a new program, as described in LRA Section B.3.27 and as stated in GALL AMP XI.E3.

In its response dated October 13, 2009, the applicant stated that the statement concerning the first test having already been performed has been removed from the program basis document to make it consistent with GALL AMP XI.E3.

Based on its review, the staff finds the applicant's response to RAI B.3.27-5 acceptable because the applicant revised the program basis document to be consistent with GALL AMP XI.E3, including the "detection of aging effects" program element. The staff's concern described in RAI B.3.27-5 is resolved.

Based on its audit and review of the applicant's response to RAIs B.3.27-1, B.3.27-2, B.3.27-3, B.3.27-4, and B.3.27-5, the staff finds that elements one through six of the applicant's Inaccessible Medium-Voltage Cables Program are consistent with the corresponding program elements of GALL AMP XI.E3 and, therefore, acceptable.

Operating Experience. LRA Section B.3.27 summarizes operating experience related to the Inaccessible Medium-Voltage Cables Program. The applicant stated that its program is a new program and, therefore, there is no programmatic plant-specific program operating experience for program effectiveness. The applicant also stated industry and plant-specific operating experience will be evaluated in the development and implementation of this program. The applicant further stated that past inspections and monitoring activities have not revealed degradation of insulation resistance. LRA Section B.3.27 also states that inspection of manholes and sump pumps have identified water in the manholes and inoperable sump pumps. The applicant stated that these issues have been documented and addressed using the applicant's corrective action program. The applicant's program basis document states that, in 2008, the Cedar River flooded the plant site. The flood waters covered the manholes between the main plant area and the intake structure. The applicant inspected the manholes after the flood and noted that the manholes had wet floors with a layer of silt except for one of the manholes where the sump pump failed, resulting in cables being submerged. The applicant initiated a work order to replace the sump pump. No cable failures were observed and no ground alarms were received during the event.

The applicant inspected the manholes containing cables within the scope of program of AMP XI.E3. The applicant noted water in manholes 1MH109 and 2MH207, with no cable or raceway submergence noted. During the audit, the NRC staff performed a walkdown of selected manholes (2MH211/1MH113, 1MH109, and MH106), which were included within the scope of the applicant's program. During this walkdown, the staff noted that several inches of standing water was identified in manholes 2MH211/1MH113, 1MH109, and MH106. Although water was observed in the manholes, no cable or raceway submergence was observed by the staff. Manholes 2MH211/1MH113 and MH106 are equipped with sump pumps. The sump pumps are not equipped with alarms, but the applicant is currently implementing a modification to install local alarms and controls. The applicant generated corrective actions for manholes 1MH109 and 2MH207 to address standing water in these manholes.

LRA Section B.3.27 states that the Inaccessible Medium-Voltage Cables Program will test cables within the scope of the program at least once every 10 years. The Inaccessible Medium-Voltage Cables Program also states that inspection for water collection in manholes is currently being performed in the spring and fall and is based on inspection results. The applicant further stated that the frequency will not be extended to greater than once every 2 years and the actual frequency will be based on operating experience.

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

The application of AMP XI.E3 to medium voltage cables was based on the operating experience available at the time Revision 1 of the GALL Report was developed. However, recently identified industry operating experience indicates that the presence of water or moisture can be a contributing factor in inaccessible power cables failures at lower operating voltages (480V to 2kV). Applicable operating experience was identified in licensee responses to Generic Letter (GL) 2007-01, "Inaccessible or Underground Power Cable Failures that Disable Accident Mitigation Systems or Cause Plant Transients," which included failures of power cable operating at service voltages of less than 2kV where water was considered a contributing factor. The staff concluded, based on recently identified industry operating experience concerning the failure of inaccessible low voltage power cables (480V to 2kV) in the presence of significant moisture, that these cables can potentially experience age-related degradation. Because the applicant's Inaccessible Medium-Voltage Cables Program did not specifically address these inaccessible low voltage power cables, by letter dated August 16, 2010, the staff issued RAI B.3.27-7 (which superseded RAI B.3.27-6 with respect to the exposure to significant voltage criterion), requesting the applicant to:

(1) Provide a summary evaluation of recently identified industry operating experience and any plant specific operating experience concerning inaccessible low voltage power cable failures within the scope of license renewal (not subject to 10 CFR 50.49 environmental qualification requirements), and how this operating experience applies to the need for additional aging management activities at Duane Arnold Energy Center for such cables.

(2) Provide a discussion of how Duane Arnold Energy Center will manage the effects of aging on inaccessible low voltage power cables within the scope of license renewal and subject to aging management review; with consideration of recently identified industry operating experience and any plant specific operating experience. The discussion should include assessment of your aging management program description, program elements (i.e., Scope of Program, Parameters Monitored/Inspected, Detection of Aging Effects, and Corrective Actions), and FSAR summary description to demonstrate

> reasonable assurance that the intended functions of inaccessible low voltage power cables subject to adverse localized environments will be maintained consistent with the current licensing basis through the period of extended operation.

The applicant responded by letter dated August 20, 2010, and stated that it would enhance the Inaccessible Medium-Voltage Cable program to include inaccessible 480V to 2kV power cables within the program. The applicant further stated the following:

> The scope of program is expanded to include inaccessible 480V to 2kV power cables that support license renewal function and are exposed to significant moisture. Significant moisture is defined as periodic exposure that lasts more than a few days (e.g., cable wetting or submerged in water). Inaccessible is defined as cable in conduit, duct bank, or direct buried.
>
> The scope of program is also changed to revise the definition of in-scope 2kV to 35kV cables to inaccessible 2kV to 35kV power cables that support a license renewal function and are exposed to significant moisture. Significant moisture is defined as periodic exposure that lasts more than a few days (e.g., cable wetting or submerged in water). Inaccessible is defined as cable in conduit, duct bank, or direct buried. The criterion of “exposure to significant voltage” (system voltage for more than 25% of the time) is removed.
>
> The preventive actions required by the program are changed to include the manholes that contain 480V to 2kV power cables. The frequency of inspection will not change.
>
> The parameters monitored or inspected required by the program are changed to include inaccessible 480V to 2kV power cables. The best commercially available test method for 480V to 2kV power cables at the time of the test will be used.
>
> The detection of aging effects required by the program is changed to include 480V to 2kV cables. The in-scope 480V to 2kV cables will be tested for degradation of the cable insulation at least once every 10 years with the actual test frequency based on industry and plant operating experience. The inspections for water in the manholes containing 480V to 2kV cables will be inspected at least every 2 years. The actual inspection frequency will be based on plant operating experience.
>
> The operating experience reviewed by the program will be expanded to include GL 2007-01 and the associated summary report. Duane Arnold has not experienced any age related failures of inaccessible 480V to 35kV power cables.

Furthermore, the applicant indicated that the program monitoring and trending, acceptance criteria, corrective actions, confirmations process, and administrative controls will not change.

Based on its review of relevant information regarding operating experience, the staff finds that:

> The applicant has appropriately expanded the program scope to include inaccessible low voltage power cables (480V to 2kV) and eliminate the criterion of “exposure to significant voltage,” consistent with industry operating experience.

For DAEC, the proposed 10-year frequency for power cable insulation testing is appropriate because, as described in the applicant's program, (1) plant-specific operating experience has not revealed any instance of inaccessible power cable failure due to aging related effects within the scope of the Non-EQ Inaccessible Medium-Voltage Cable Program, and (2) the frequency of testing may increase based on test results and operating experience. This approach is consistent with the discussion of operating experience in the SRP, which states that applicants should consider future plant specific and applicable industry operating experience for its AMPs. The staff notes that the applicant would increase the frequency of its inspection and testing if adverse conditions are identified during future inspections (e.g., significant moisture accumulation that could lead to water intrusion).

The applicant's proposed approach for inspecting manholes containing inaccessible in-scope power cables is appropriate given the plant-specific operating experience at DAEC. The staff noted, as discussed in the "preventive actions" program element of this AMP XI.E3, that DAEC also uses sump pumps, installed in the majority of manholes, to prevent cables from being exposed to significant moisture. The applicant's program basis document states that its program consists of periodically inspecting the manholes for moisture and ensuring that the sump pumps in the manholes are operational. The program basis document further states that the sump pumps will drain the water as necessary and the sump pumps will keep the water below the level of the cables during normal seasonal conditions. Given that the plant-specific operating experience has shown no significant water accumulation in manholes containing cables within the scope of this AMP, and because the applicant is currently inspecting for water collection in manholes in the spring and fall to determine the actual inspection frequency, not to exceed greater than once every 2 years, the proposed two-year inspection frequency is acceptable since the applicant's current inspection effort will continue to inform the program's inspection periodicity.

In addition, in Duane Arnold Energy Center NRC License Renewal Scoping, Screening, and Aging Management Inspection Report 05000331/2009010 (DRS), the staff noted that in 2011, the licensee intends to pull a section of buried cable to examine for moisture damage. Further cable replacement will be dependent on the test results. The current program of inspecting manholes for water intrusion and ensuring sump pump operation will continue.

The staff finds that, with the enhancements discussed above, the Non-EQ Inaccessible Medium-Voltage Cable Program will adequately manage the aging effects of inaccessible power cables, consistent with DAEC's plant-specific operating experience, such that there is reasonable assurance that inaccessible power cables (480V to 35kV) subject to significant moisture will be adequately managed during the period of extended operation. The staff's concern described in RAI B3.27-7 is resolved.

Based on its audit and review of the application, the staff finds that operating experience related to the applicant's program demonstrates that the program can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking corrective actions.

The staff also verified that the aging effects are bounded by those identified in GALL AMP XI.E3 and the more recent operating experience identified in GL 2007-01. 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.

UFSAR Supplement. LRA Section 18.1.27 provides the UFSAR supplement for the Inaccessible Medium-Voltage Cables Program. The staff reviewed this UFSAR supplement description of the program against the recommended description for this type of program as described in SRP-LR Table 3.6-2.

GALL AMP XI.E3 states that significant moisture is defined as periodic exposure to moisture that lasts more than a few days (e.g., cables in standing water). LRA Section 18.1.27 states that medium-voltage cables exposed to significant moisture are within the scope of license renewal. LRA Section B.3.27 states that the program includes medium-voltage cables susceptible to submergence. Basis document LRAP-E003 states that the Inaccessible Medium-Voltage Cables Program applies to cables subjected to long term moisture.

LRA Section 18.1.27, the applicant's program basis document, and LRA Section B.3.27 are inconsistent with SRP-LR Table 3.6-2 and GALL AMP XI.E3 which states that significant moisture is defined as periodic exposure that lasts more than a few days (e.g., cables in standing water).

During a conference call occurring on November 12, 2009, the staff asked the applicant to explain how LRA Section 18.1.27, the applicant's program basis document, and LRA Section B.3.27 are consistent with SRP-LR Table 3.6-2 and GALL AMP XI.E3 which states that significant moisture is defined as periodic exposure that lasts more than a few days (e.g., cables in standing water). By letter dated December 14, 2009, the applicant revised LRA Section 18.1.27 and LRA Section B.3.27 to include the statement, "significant moisture is defined as a periodic exposure to moisture that lasts more than a few days (e.g., cables in standing water)," to ensure the LRA is consistent with the GALL Report terminology for "significant moisture."

Based on its review, the staff finds the applicant's revision to LRA Section 18.1.27 and LRA Section B.3.27 acceptable because LRA Section 18.1.27 and LRA Section B.3.27 are now consistent with SRP-LR Table 3.6-2 and GALL AMP XI.E3 with respect to defining significant moisture.

The staff also notes that the applicant committed (Commitment No. 19) to implement the new Inaccessible Medium-Voltage Cables Program prior to entering the period of extended operation for managing aging of applicable components and complete the first inspection or test prior to the period of extended operation. The applicant also included a new Commitment No. 54 to add inaccessible 480V to 2kV power cables to the Inaccessible Medium-Voltage Cables Program, which will be implemented prior to the period of extended operation.

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

Conclusion. On the basis of its audit and review of the applicant's Inaccessible Medium-Voltage Cables Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.20 Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program

Summary of Technical Information in the Application. LRA Section B.3.28 describes the new Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program as consistent with GALL AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components.” The applicant stated that the program manages the effects of aging due to loss of material, heat transfer degradation, cracking, and fouling and that the program consists of inspections of internal surfaces of steel piping, piping components, ducting, and other components that are not covered by other AMPs, as well as materials such as stainless steel, CASS, galvanized steel, bronze, brass, admiralty brass, copper and copper alloy, aluminum alloy, and nickel. The applicant also stated that the program includes external inspections of submerged piping not frequently accessible; including piping that is normally submerged and has the function of a secondary containment boundary, and external inspection of some safety-related heating, ventilation, and air conditioning (HVAC) equipment not normally open for inspection or monitoring. The applicant further stated that the program inspections are inspections of opportunity that are performed during periodic system and component maintenance conducted during power operations or outages.

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

The staff compared elements one through six of the applicant’s program to the corresponding elements of GALL AMP XI.M38. As discussed in the Audit Report, the staff confirmed that each element of the applicant’s program is consistent with the corresponding element of GALL AMP XI.M38, with the exception of the “scope of the program,” and “monitoring and trending” program elements. For these elements, the staff determined the need for additional clarification which resulted in the issuance of RAIs.

The “monitoring and trending” program element of GALL AMP XI.M38 recommends that inspection intervals are dependent on component material and environment, and take into consideration industry and plant-specific operating experience and further, that inspection results are monitored and trended. During its audit, the staff found that the applicant’s Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program does not specifically commit to trending of aging degradation, having inspection intervals dependent on component material and environment, and consideration of industry operating experience. By letter dated September 14, 2009, the staff issued RAI B.3.28-1 requesting that the applicant provide specific commitments to trending of aging degradation, having inspection intervals dependent on component material and environment, and consideration of industry operating experience, or provide the technical basis for this program’s consistency with GALL AMP XI.M38.

In its response dated October 13, 2009, the applicant stated that the program basis document for this program has been revised to include inspection intervals dependent on component material and environment, to consider industry and plant-specific experience, and to require that any aging degradation identified be trended.

Based on its review, the staff finds this program element acceptable because the applicant revised its program basis document to include consideration of industry and plant-specific operating experience to determine inspection intervals and that any aging degradation identified will be trended. The staff's concern described in RAI B.3.28-1 is resolved.

The "scope of the program" program element of GALL AMP XI.M38 recommends that internal surfaces of steel piping, piping elements, ducting, and components be included in the program. During its audit, the staff found that the applicant stated that this program is relied upon to manage materials beyond the scope of the GALL AMP XI.M38, including stainless steel, CASS, galvanized steel, bronze, brass, admiralty brass, copper and copper alloy, aluminum alloy, and nickel in a variety of environments. The applicant had also expanded the scope of aging effects managed by this AMP to include cracking in stainless steel, heat transfer degradation, and loss of material in various materials and environments.

By letter dated January 6, 2010, the staff issued RAI B.3.28-2 requesting that the applicant provide justification that the program is adequate for managing the aging effects of cracking in stainless steel, heat transfer degradation, and loss of material in the stainless steel, CASS, galvanized steel, bronze, brass, admiralty brass, copper and copper alloy, aluminum alloy, and nickel components in the environments as stated in the LRA. The staff also requested that the applicant identify and justify the inspection techniques used by this program that will be capable of detecting cracking for stainless steel components and heat transfer degradation added to the scope of this program or provide an appropriate program to manage these aging effects for the applicable components.

In its response dated February 2, 2010, the applicant stated the internal and external experience reviewed to determine appropriate aging mechanisms, and the basis determining the adequacy of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program for managing aging effects for the various materials, components, and environments identified in the LRA. The applicant's response also identified the inspection techniques and procedures, and justification for its use, to manage aging effects in stainless steel and other materials as stated in the LRA. The staff finds this program element acceptable because the applicant's response provided adequate justification for the program adequacy, and identified and provided adequate justification of its capability to detect aging effects. The staff's concern described in RAI B.3.28 is resolved.

Based on its audit and review of the applicant's response to RAIs B.3.28-1 and B.3.28-2, the staff finds that elements one through six of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program are consistent with the corresponding program elements of GALL AMP XI.M38 and, therefore, acceptable.

<u>Operating Experience</u>. LRA Section B.3.28 summarizes operating experience related to the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant stated that this is a new program, for which there is no plant-specific operating experience to determine the program effectiveness. The applicant also stated that industry operating experience will be evaluated in the development and implementation of this program and as operating experience is obtained, lessons learned will be appropriately incorporated into the program. The staff determined the need for additional information regarding the applicant's search and review of industry operating experience and its utilization and implementation for this AMP. As noted in the staff evaluation section above, by letter dated January 6, 2010, the staff issued RAI B.3.28 requesting that the applicant provide specific information justifying the

adequacy of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage the aging effects noted in the LRA.

In its response dated February 2, 2010, the applicant stated the internal and external experience reviewed to determine appropriate aging mechanisms, and the basis determining the adequacy of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program for managing aging effects for the various materials, components, and environments identified in the LRA. The applicant's response also stated that generic industry experience, including NRC information notices (INs), was reviewed as well as the DAEC corrective action program database. Operating experience identified by other plant LRAs, license renewal SERs, and the GALL Report were reviewed and used to determine aging mechanisms that may be managed by this program. The staff finds the applicant's response to RAI B.3.28 provided specific information regarding operating experience reviewed and used to support the adequacy of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and is, therefore, acceptable. The staff's concern described in RAI B.3.28 is resolved.

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

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

Based on its audit and review of the application, and review of the applicant's response to RAI B.3.28-3, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program will result in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

UFSAR Supplement. LRA Section 18.1.28 provides the UFSAR supplement for the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff reviewed this UFSAR supplement summary description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Tables 3.2-2, 3.3-2, and 3.4-2.

The staff also notes that the applicant committed (Commitment No. 20) to implement the Internal Surfaces in Miscellaneous Piping and Ducting Components Program prior to the period of extended operation for managing aging of the applicable components.

The staff determines that the information in the UFSAR supplement is an adequate summary description of the program as required by 10 CFR 54.21(d)

Conclusion. On the basis of its review of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, the staff finds all program elements consistent with the GALL Report. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions of these components will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.21 One-Time Inspection Program

Summary of Technical Information in the Application. LRA Section B.3.32 describes the new One-Time Inspection Program as consistent with GALL AMP XI.M32. The applicant stated that this program assesses aging effects of loss of material due to corrosion (crevice, galvanic, general, and pitting); loss of material due to MIC; loss of material due to erosion; loss of heat transfer due to fouling; and cracking due to SCC or cyclic loading of susceptible components. The applicant further stated that this program addresses potentially long incubation periods for certain aging effects and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effects on the intended function of the structure or component. The applicant stated that this program is used to verify the effectiveness of the Fuel Oil Chemistry, Water Chemistry, and Lube Oil Analysis programs.

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

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M32. As discussed in the audit report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M32, with the exception of the "detection of aging effects" program element. For this element the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

The "detection of aging" effects program element of GALL AMP XI.M32 recommends that:

(1) The inspection includes a representative sample of the system population and, where practical, focuses on the bounding or lead components most susceptible to aging due to time in service, severity of operating conditions, and lowest design margin.

(2) The program will rely on established NDE techniques, including visual, ultrasonic, and surface techniques that are performed by qualified personnel, following procedures consistent with the ASME Code and 10 CFR Part 50, Appendix B. The inspection and test techniques will have a demonstrated history of effectiveness in detecting the aging effect of concern.

(3) Typically, the one-time inspections should be performed as indicated in the GALL AMP XI.M32 table on page XI M-107.

The staff noted that the applicant's LRA and associated basis document do not provide criteria that will be used to select locations and sample sizes for one-time inspections, nor do they specify the techniques to be used to detect various aging effects.

By letter dated September 14, 2009, the staff issued RAI B.3.32-1 requesting the applicant identify the methods that will be used to select components for inspection and for expanding the inspection scope if degradation is detected in the components.

In its response dated October 13, 2009, the applicant stated that the One-Time Inspection Program will be based on the premise that inspection of those areas most susceptible to aging can be used to confirm performance in less susceptible areas, without the need for further inspections. The applicant also stated that the technical review will include establishing a listing of scoped components with material and environment combinations most susceptible to the identified aging effects/mechanisms. Plant piping and instrumentation diagrams (P&IDs) and other documents will be referred to for assistance in selecting the most susceptible areas, such as those areas that experience low flow or stagnant conditions. The staff noted that, in its response to the RAI, the applicant established specific sample groups based on fuel oil, lube oil, reactor coolant/sodium pentaborate and steam/treated water environments where the minimum sample size is identified for specific aging effect/material combinations.

Based on its review, the staff finds the applicant’s response to RAI B.3.32-1 acceptable because the program will be in accordance with the recommendations of the “detection of aging effects” program element of GALL AMP XI.M32, which recommends the inspections include a representative sample of the system population and focus on the bounding or lead components for specific material/environment combinations and because the inspections will be performed in accordance with the table on page XI M-107 in GALL AMP XI.M32. The staff’s concerns described in RAI B.3.32-1 are resolved.

The “detection of aging effects” program element of GALL AMP XI.M32, recommends that, with respect to inspection timing, the population of components inspected before the end of the current operating term needs to be sufficient to provide reasonable assurance that the aging effects will not compromise any intended function at any time during the period of extended operation.

The staff noted that one-time inspections cannot practically take place in the last RFO before entering the period of extended operation. By letter dated September 14, 2009, the staff issued RAI B.3.32-2 requesting that the applicant provide timing for the various inspections showing that all inspections will be performed before entering the period of extended operation.

In its response dated October 13, 2009, the applicant stated that there are two RFOs scheduled prior to entering the period of extended operation in February 2014. RFO 22 is scheduled for October 2010 and RFO 23 is scheduled for October 2012, at which times selected components will be identified to ensure that the required inspections are performed before entering the period of extended operation. The applicant also stated that the scope of each outage will be reviewed for opportunities to credit an existing activity for one-time inspections and will schedule additional inspections where opportunistic inspections may not accommodate completing all of the required one-time inspections in the available timeframe before the extended period of operation.

Based on its review, the staff finds the applicant’s response to RAI B.3.32-2 acceptable because the inspection timing will allow performance of all one-time inspections before entering the period of extended operation which is in accordance with the recommendation of the “detection of aging effects” program element in GALL AMP XI.M32. The staff’s concern described in RAI B.3.32-2 is resolved.

Based on its audit and review of the applicant's responses to RAIs B.3.32-1 and B.3.32-2, the staff finds that elements one through six of the applicant's One-Time Inspection Program are consistent with the corresponding program elements of GALL AMP XI.M32 and, therefore, acceptable.

Operating Experience. LRA Section B.3.32 summarizes operating experience related to the One-Time Inspection Program. The applicant stated that its One-Time Inspection Program is a new program and, therefore, there is no plant-specific program operating experience for program effectiveness.

The staff noted that although there is no captured plant-specific operating experience related to this program because the program is new, any operating experience resulting from maintenance, etc., should be included for systems and components that will included in the One-Time Inspection Program.

By letter dated September 14, 2009, the staff issued RAI B.3.32-3 requesting that the applicant provide a summary of operating experience based on observations resulting from maintenance and corrective action activities.

In its response dated October 13, 2009, the applicant stated that 32 initial opportunistic inspections of components scoped for the program were performed during the February 2009 RFO and that these initial inspections identified no passive components with loss of material due to corrosion.

The staff noted that the documentation provided by the applicant during the staff's AMP audit, supported the applicant's statements regarding operating experience and confirmed that the plant-specific operating experience for components exposed to fuel oil, lube oil, and treated water is bounded by industry experience.

Based on its review, the staff finds the applicant's response to RAI B.3.32-3 acceptable because the applicant provided operating experience based on opportunistic inspections for components that will be included in the One-Time Inspection Program when it is implemented. The staff's concern described in RAI B.3.32-3 is resolved.

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

Based on its audit and review of the application, and review of the applicant's response to RAI B.3.32-3, the staff finds that the applicant's program will be able to demonstrate that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program will result in the applicant taking appropriate corrective actions. The staff confirmed that the operating experience program element satisfies the criterion defined in the GALL Report and in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

UFSAR Supplement. LRA Section A.18.1.32 provides the UFSAR supplement for the One-Time Inspection Program.

The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR

Tables 3.1-2, 3.2-2, 3.3-2, and 3.4-2. The staff also notes that the applicant committed (Commitment No. 25) to implement the new One-Time Inspection Program prior to entering the period of extended operation for managing aging of applicable components.

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

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

3.0.3.1.22 Open-Cycle Cooling Water System Program

Summary of Technical Information in the Application. LRA Section B.3.33 describes the existing "Open-Cycle Cooling Water System Program" as consistent with GALL AMP XI.M20. The applicant stated that the program will manage the effects of loss of material and heat transfer degradation in fouling. The applicant also stated that the program will manage the aging effects 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 staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated. The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M20. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M20, with the exception of the "preventive actions," "parameters monitored/inspected," and "monitoring and trending" program elements. For these elements, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

The "preventive actions" program element of GALL AMP XI.M20 recommends that system components should be constructed of appropriate materials and be lined or coated to protect the underlying metal surfaces; however, during its audit, the staff found that the applicant's Open-Cycle Cooling Water System Program states that open-cycle cooling water piping is constructed from carbon steel that is not lined or coated. By letter dated September 14, 2009, the staff issued RAI B.3.33-1 requesting that the applicant commit to revise the program to show the inclusion of unlined pipe as an exception and to justify why the proposed program is sufficient to manage the aging of unlined pipe.

In its response dated October 13, 2009, the applicant stated that it had revised the program to take an exception to the GALL AMP XI.M20 program elements "scope of the program," "preventive actions," "parameters monitored/inspected," "detection of aging effects," and "monitoring and trending," because the piping included within the scope of the program is constructed of carbon steel that is not lined or coated. The applicant also stated that the program is sufficient to manage the aging of unlined piping in that its raw water is non-aggressive; that periodic visual, eddy current, and UT inspections are performed on open-cycle cooling water piping and heat exchangers; and that plant operating experience supports the effectiveness of the program. During its review of the applicant's response, the staff noted that GALL AMP XI.M20 states that visual inspections of open-cycle cooling water piping should be conducted and that UT and eddy current testing may be effective additions to the program when necessary.

The staff finds this response acceptable because it correctly shows the inclusion of unlined open-cycle cooling water piping as an exception to the GALL Report AMP. The AMP contains inspection and testing components appropriate for the management of corrosion in unlined open-cycle cooling water piping and the applicant's internal operating experience supports the effectiveness of the program. The staff's concern described in RAI B.3.33-1 is resolved.

The staff also reviewed the portions of the "scope of the program," "preventive actions," "parameters monitored/inspected," "detection of aging effects," and "monitoring and trending" program elements associated with the exception to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this exception follows.

Exception. LRA Section B.3.33, as amended by letter dated October 13, 2009, states an exception to the "scope of the program," "preventive actions," " parameters monitored/inspected," "detection of aging effects," and "monitoring and trending" program elements. The exception, as discussed in RAI B.3.33-1, expands the program's scope to include carbon steel pipe that is not lined or coated. The staff finds this exception acceptable because the AMP contains inspection and testing components appropriate for the management of corrosion in unlined open-cycle cooling water piping, and the applicant's internal operating experience supports the effectiveness of the program.

Based on its audit and review of the applicant's response to RAI B.3.33-1, the staff finds that elements one through six of the applicant's Open-Cycle Cooling Water System Program, with acceptable exception, are consistent with the corresponding program elements of GALL AMP XI.M20 and are, therefore, acceptable.

Operating Experience. LRA Section B 3.33 summarizes operating experience related to the Open-Cycle Cooling Water System Program. The applicant stated that the program has been effective in managing the aging effects of loss of material and heat transfer degradation fouling and incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended functions throughout the period of extended operation. The applicant also stated that the program effectiveness has been demonstrated by various assessments and system operational performance. The applicant further stated that corrosion and material condition issues have been documented and evaluated in the corrective action program.

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

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

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

UFSAR Supplement. LRA Section A.18.1.33 provides the UFSAR supplement for the Open-Cycle Cooling Water System Program. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Tables 3.1-2, 3.2-2, 3.3-2, and 3.4-2.

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

Conclusion. On the basis of its audit and review of the applicant's Open-Cycle Cooling Water System Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and 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 the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.23 Reactor Head Closure Studs Program

Summary of Technical Information in the Application. LRA Section B.3.34 describes the existing Reactor Head Closure Studs Program as consistent with the GALL AMP XI.M3, "Reactor Head Closure Studs." The applicant stated that its program is an integral part of its ASME Section XI Inservice Inspection (ISI) Program. The applicant also stated that the program manages the aging effects of cracking due to SCC or IGSCC and loss of material due to wear. The applicant further stated that the program includes preventive measures to mitigate cracking and these measures include material selection, appropriate coatings, and lubrications which follow the guidelines of RG 1.65.

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

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M3. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M3, with the exception of the "detection of aging effects" program element. For this element, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

The staff noted that in the "detection of aging effects" program element of the applicant's program, the applicant referenced its ISI administrative manual for inspection of reactor closure head bolts. In a footnote to attachment III of the manual, the applicant stated that when bolts or studs are removed for examination, surface examination meeting the acceptance standards of ASME Code Section XI, IWB-3515 may be substituted for volumetric examination. The staff noted that in the "detection of aging effects" program element of GALL AMP XI.M3 states that surface and volumetric examinations are performed on the studs when they are removed. By letter dated September 14, 2009, the staff issued RAI B.3.34-1 requesting the applicant justify why this is not considered an exception to GALL AMP XI.M3.

In its response dated October 13, 2009, the applicant amended its LRA to add an exception to the Reactor Head Closure Studs Program. The applicant stated that this exception affects the "detection of aging effects" program element.

Based on its review, the staff finds the applicant's response to RAI B.3.34-1 acceptable because the applicant amended its LRA to identify an exception to the "detection of aging effects" program element. The staff's review of this newly identified exception and its acceptability is discussed below. The staff's concern described in RAI B.3.34-1 is resolved.

The staff also reviewed the portions of the "detection of aging effects" program element associated with the exception, as amended by letter dated October 13, 2009, to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this exception follows.

Exception. LRA Section B.3.34 states an exception to the "detection of aging effects" program element, as amended by letter dated October 13, 2009. The applicant stated that the GALL Report recommends that both surface and volumetric inspections of studs are performed when they are removed. The applicant further stated that the inspection is performed in accordance with the applicable portions of ASME Code Section XI and 10 CFR 50.55a which do not necessarily require both inspections.

The staff noted that the program description of GALL AMP XI.M3 identifies inspections to be performed in conformance with ASME Code Section XI, Subsection IWB (2001 edition including the 2002 and 2003 addenda), Table IWB 2500-1. The staff noted that Table IWB 2500-1 of ASME Code Section XI requires either surface or volumetric examination of studs when removed. The staff determines that the GALL AMP XI.M3 recommendation of surface and volumetric examination in the "detection of aging effects" program element was from the 1995 edition of ASME Code Section XI, Table IWB 2500-1.

Based on its review, the staff finds this exception acceptable because the applicant is in conformance with the ASME Code Section XI, Subsection IWB (2001 edition including the 2002 and 2003 addenda), Table IWB 2500-1 and, therefore, is consistent with the recommendations of GALL AMP XI.M3.

Based on its audit and review of the applicant's response to RAI B.3.34-1, the staff finds that elements one through six of the applicant's Reactor Head Closure Studs Program, with an acceptable exception, are consistent with the corresponding program elements of GALL AMP XI.M3 and are, therefore, acceptable.

Operating Experience. LRA Section B.3.34 summarizes operating experience related to the Reactor Head Closure Studs Program. The applicant stated that plant-specific operating experience did not reveal any degradation. After reviewing the operating experience reports provided in the LRA and in the program basis documents, the staff confirmed that the plant-specific operating experience reviewed did not reveal any reactor head closure stud cracking or loss of material, or any other age related degradation with the RPV head studs, nuts, or washers.

The staff reviewed operating experience information in the application and during the audit to determine whether or not the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program.

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

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

UFSAR Supplement. LRA Section 18.1.34 provides the UFSAR supplement for the Reactor Head Closure Studs Program. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.1-2.

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

Conclusion. On the basis of its audit and review of the applicant's Reactor Head Closure Studs Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. In addition, the staff reviewed the exception and its justification and 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 the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.24 Selective Leaching of Materials Inspection Program

Summary of Technical Information in the Application. LRA Section B.3.36 describes the new Selective Leaching of Materials Program as consistent with GALL AMP XI.M33, "Selective Leaching of Materials." The applicant stated that the program will ensure that cast iron, brass, bronze, and copper alloy components exposed to raw water, treated water, or groundwater will maintain their integrity for the period of extended operation.

The applicant also stated that its program will include the use of a one-time visual inspection and hardness measurement and/or mechanical test of selected components that may be susceptible to selective leaching. The applicant further stated that the program will determine whether loss of materials due to selective leaching is occurring, and if this will affect the component's ability to perform their intended function for the period of extended operation.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated. The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M33. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M33, with the exception of the "scope of the program," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements. For these elements, the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

The staff reviewed the applicant's program basis document and noted that additional details were required in order for the staff to complete its review for consistency with GALL AMP XI.M33. By letter dated September 14, 2009, the staff issued RAI B.3.36-1 requesting that the applicant provide the specific details, as discussed below, for the "scope of the program," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements.

(1) The staff reviewed the applicant's program basis document for the "scope of the program" program element and noted that it did not contain sufficient detail for the staff to determine whether the program element is consistent with GALL AMP XI.M33. Specifically, the staff requested that the applicant provide more detail in relation to the identification of the inspection population and sample size basis and that the program address aging effects on internal and external surfaces, as appropriate.

(2) The staff reviewed the applicant's program basis document for the "parameters monitored/inspected" program element and noted that it did not contain sufficient detail for the staff to be able to find that the program element is consistent with GALL AMP XI.M33. Specifically, the staff requested that the applicant provide more detail in relation to the parameters to be monitored or inspected, including the methods or techniques to be used, and the specifics of the hardness measurements to detect and confirm aging effects resulting from selective leaching.

(3) The staff reviewed the applicant's program basis document for the "detection of aging effects" program element and noted that it did not contain sufficient detail for the staff to determine whether the program element is consistent with GALL AMP XI.M33. Specifically, the staff requested that the applicant provide more detail in relation to the inspection population and sample size for the one-time inspection and hardness measurements, if the program will inspect external as well as internal surfaces, and what constitutes other mechanical tests.

(4) The staff reviewed the applicant's program basis document for the "acceptance criteria" program element and noted that it did not contain sufficient detail for the staff to be able to determine whether the program element is consistent with GALL AMP XI.M33. Specifically, the staff requested that the applicant provide more detail in relation to the acceptance criteria for hardness and other mechanical inspection techniques, and clarify what constitutes identification of selective leaching which would lead to further engineering evaluation.

In its response dated October 13, 2009, the applicant stated the following:

(1) A minimum of one type of component/material type subjected to raw water, treated water, or groundwater will be inspected. The applicant also stated that both internal and external inspections would be conducted depending upon the environment and surface susceptibility for the selected component. The staff finds this response acceptable because the applicant will inspect an appropriate sample size, and both internal and external surfaces will be inspected based on the material and environment.

(2) Parameters such as iron oxide coloration, rust, and honeycomb-like configurations would be inspected, in addition to hardness testing. The applicant also stated that it would use other techniques based on industry experience such as scraping, chipping, and hammer impact testing to visually inspect the component integrity at the impacted surface. The staff finds this response acceptable because the applicant, based on industry operating experience, will be using appropriate inspection techniques to determine aging effects associated with selective leaching.

(3) Clarifying the basis for the inspection population and sample size for the one-time inspection and hardness measurements, confirmed the program will evaluate the external, as well as internal surfaces to detect internal or external corrosion caused by selective leaching, and the basis and activities to evaluate and apply other appropriate mechanical tests. The staff finds this response acceptable because the applicant will inspect an appropriate sample size and both internal and external surfaces based on the material and environment; furthermore, the applicant is using industry operating experience to determine other appropriate mechanical tests.

(4) Visual inspections and hardness tests would identify components for which selective leaching is present. The applicant also stated that if selective leaching is suspected, the corrective action process would be initiated and an engineering evaluation to determine the root cause would be conducted. The applicant further stated that determination of additional inspections or testing to confirm the identified failure mechanism may occur as a result of the corrective action. The staff finds this response acceptable because the applicant will enter a corrective action process for any suspected selective leaching which will ensure that an engineering evaluation and corrective actions will occur.

Based on its review as discussed above, the staff finds the applicant's response to RAI B.3.36-1 acceptable. The staff's concerns described in RAI B.3.36-1 are resolved.

Exception 1. LRA Section B.3.36, as amended by letter dated January 14, 2010, states an exception to the "detection of aging effects" program element. The applicant stated that visual inspection and mechanical test techniques (Brinnell hardness testing or other mechanical tests, such as mechanical scraping, chipping, or other hardness testing), or additional examination methods that become available to the nuclear industry, are used to determine if selective leaching is occurring on the surfaces of a selected set of components. The applicant further stated that visual inspection is capable of detecting corrosion while mechanical test techniques such as chipping, scraping, or hardness testing are capable of detecting a corroded or weakened component structure. The staff noted that the GALL Report recommends that visual inspections be performed with Brinnell hardness testing. The staff finds the exception acceptable because the other mechanical tests and examination methods the applicant proposes to use will be based on industry operating experience.

Based on its audit and review of the applicant's response to RAI B.3.36-1, the staff finds that elements one through six of the applicant's Selective Leaching of Materials Program, with acceptable exception, are consistent with the corresponding elements of GALL AMP XI.M33 and are, therefore, acceptable.

Operating Experience. LRA Section B.3.36.5 summarizes operating experience related to the Selective Leaching of Materials Program. The applicant stated that this is a new program, for which there is no plant-specific operating experience to determine the program effectiveness. The applicant also stated a past example where inspections/monitoring activities revealed plant-specific selective leaching by graphitization removal of an alloying element, that was documented and addressed using the corrective action program. The applicant further stated that industry operating experience will form the basis for this program.

By letter dated September 14, 2009, the staff issued RAI B.3.36-2 requesting that the applicant provide additional information regarding the applicant's search and review of industry operating experience, and its utilization and implementation for this program.

In its response dated October 13, 2009, the applicant stated that industry operating experience related to selective leaching will be evaluated to determine if the identified materials and environment are applicable and this input would be used for the development and planned implementation of the program. The applicant also stated that it had completed a search through its corrective action database for 1997 to 2008, and concluded that there were no confirmed leaching failures in that period.

Based on its review, the staff finds the applicant's response to RAI B.3.36-2 acceptable because the program will be based upon a search of industry operating experience and the applicant reviewed its internal operating experience. The staff's concern described in RAI B.3.36-2 is resolved.

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

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

Based on its audit and review of the application, and review of the applicant's response to RAI B.3.36-2, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

UFSAR Supplement. LRA Section A.18.1.36 provides the UFSAR supplement for the Selective Leaching of Materials Program. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the staff's recommended description for this type of program as described in SRP-LR Tables 3.1-2, 3.2-2, and 3.3-2.

The staff also notes that the applicant committed (Commitment No. 29) to implement the new Selective Leaching of Materials Program prior to the period of extended operation for managing aging of applicable components.

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

Conclusion. On the basis of its review of the applicant's Selective Leaching of Materials Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL report are consistent. In addition, the staff reviewed the exception and its justification and determines that the AMP, with the exception, is adequate to manage the aging effects for which it is credited in the LRA. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.25 Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel Program

Summary of Technical Information in the Application. LRA Section B.3.38 describes the new Thermal Aging and Neutron Irradiation Embrittlement of CASS Program as consistent with GALL AMP XI.M13, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)." The applicant stated that this program manages potential reduction of fracture toughness due to thermal aging and neutron irradiation embrittlement. The applicant further stated that the material identified as applicable to this program is located internal to the RPV. The applicant stated that the specific components are the fuel support casting, fittings on the core spray sparger, the jet pump ram head, and the jet pump nozzles. The applicant stated that these components are made of ASTM 351 Grade CF8 material.

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

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M13. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M13, with the exception of the "scope of the program," and "detection of aging effects" program elements. For these elements, the staff determines the need for additional clarification, which resulted in the issuance of RAIs.

During its audit, the staff could not determine the basis for certain assumptions the applicant made when calculating the ferrite concentration for its Grade CF8 material in the "scope of the program" program element. By letter dated September 14, 2009, the staff issued RAI B.3.38-1 requesting that the applicant provide additional information that justifies the use of 0.0 weight percent for molybdenum in Hull's equivalent factors when the maximum concentration of 0.5 weight percent is possible. Also, the staff requested additional information that justifies the use of 0.04 weight percent nitrogen in Hull's equivalent factors when NUREG/CR-4513, Revision 1 indicates that nitrogen may be as low as 0.028 weight percent. Furthermore, if updated values for molybdenum and nitrogen indicate that the ferrite content is greater than 25 percent, provide additional information describing what additional actions will be taken regarding flaw evaluation to be consistent with the GALL Report.

In its response dated October 13, 2009, the applicant stated that for calculating the ferrite content of the CASS material, it will use 0.5 weight percent for molybdenum, which is the maximum value stated in the current ASTM standard for Grade CF8 material. The applicant stated that it will continue to use the 0.04 weight percent nitrogen for calculating the ferrite content. Based upon these values, the applicant has calculated a ferrite content of 20.99 weight percent for its CASS material.

Based on its review, the staff finds the applicant's response to RAI B.3.38-1 acceptable because the applicant has used the maximum value of molybdenum from the current ASTM standard, which would predict the highest ferrite content. The staff determines the use of 0.04 weight percent nitrogen is acceptable because the reference NUREG/CR-4513, Revision 1, indicates that this value should be used when the nitrogen concentration is unknown. The staff determines that when using these values, the calculated ferrite content is above 20 percent, requiring the evaluation of thermal embrittlement, which the applicant has already taken into account. However, the staff noted that the ferrite concentration calculation is below 25 percent, so no additional actions are required by the applicant. The staff's concern described in RAI B.3.38-1 is resolved.

During its audit, the staff could not determine whether the applicant's program would be able to detect an embrittlement flaw because there is no statement on the inspection program's capability to detect these flaws in the "detection of aging effects" program element. By letter dated September 14, 2009, the staff issued RAI B.3.38-2 requesting the applicant describe how the visual inspection used in this program will achieve the 0.0005-inch flaw size resolution as indicated in GALL AMP XI.M13. Furthermore, if the applicant cannot achieve this resolution, the staff requested additional information that demonstrates that the enhanced visual testing (EVT-1) technique will be able to detect the critical flaw size associated with thermal aging and neutron irradiation embrittlement of CASS.

In its response dated October 13, 2009, the applicant stated that it will use visual inspections in accordance with the applicable requirements of the ASME Code Section XI and guidance from BWRVIP documents. The applicant further stated the resolution requirement for EVT-1 examination defined in BWRVIP-03 and ASME Code Section XI requires resolution of characters with a 0.044-inch height. The applicant stated this use of the 0.044-inch character height meets the requirements set forth in the Table IWA-2210-1. The applicant has acknowledged that the previous versions of the visual inspections used the resolution of a 0.0005-inch line; however, this has been modified to indicate the acceptance of the 0.044-inch character resolution.

The staff finds the applicant's response to RAI B.3.38-2 acceptable because the applicant will use the current visual inspection requirements of the 0.044-inch character height in the ASME Code Section XI, that have been accepted in 10 CFR 50.55a, and BWRVIP documents. The staff's concern described in RAI B.3.38-2 is resolved.

Based on its audit, and review of the applicant's response to RAI B.3.38-1 and RAI B.3.38-2, the staff finds that elements one through six of the applicant's Thermal Aging and Neutron

Irradiation Embrittlement of CASS Program, are consistent with the corresponding program elements of GALL AMP XI.M13 and are, therefore, acceptable.

Operating Experience. LRA Section B.3.38 summarizes operating experience related to the Thermal Aging and Neutron Irradiation Embrittlement of CASS Program. The applicant stated that this is a new program and that no plant-specific operating experience is available. The applicant further stated that the inspection method is very similar to ASME Code Section XI ISI, Subsection IWB, IWC, and IWD and the BWRVIP programs. The applicant stated that the ISI operating experience was included. In addition, the applicant stated that when implementing this program, the applicant considers both industry operating experience and plant-specific information. The staff reviewed the RFO 20 ISI documentation of support casting and jet pump assemblies, which revealed no relevant indications.

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

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

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

UFSAR Supplement. LRA Section 18.1.38 provides the UFSAR supplement for the Thermal Aging and Neutron Irradiation Embrittlement of CASS Program. The staff compared this UFSAR supplement description of the program to the recommended description for this type of program as described in SRP-LR Table 3.1-2.

The staff could not confirm the acceptability of the applicant's UFSAR supplement because the applicant stated it will establish this program prior to the period of extended operation. However, the staff noted that SRP-LR Table 3.1-2 states that the program should be implemented before the period of extended operation.

By letter dated September 14, 2009, the staff issued the new program commitments RAI, requesting that the applicant modify the commitments for new programs so that the commitment clearly states that new programs will be implemented prior to the period of extended operation.

In its response dated October 13, 2009, the applicant stated that it has revised the commitment so that it now will be implemented prior to the period of extended operation.

Based on its review, the staff finds the applicant's response to the new program commitments RAI acceptable because the applicant will implement the commitment prior to the period of extended operation as recommended in the SRP-LR. The staff's concern described in new program commitments RAI is resolved.

The staff also notes that the applicant committed (Commitment No. 36) to implement the new Thermal Aging and Neutron Irradiation Embrittlement of CASS Program prior to entering the period of extended operation for managing aging of applicable components, as amended by letter dated October 13, 2009.

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

Conclusion. On the basis of its audit and review of the applicant's Thermal Aging and Neutron Irradiation Embrittlement of CASS Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.26 Water Chemistry Program

Summary of Technical Information in the Application. LRA Section B.3.39 describes the existing Water Chemistry Program as consistent with GALL AMP XI.M2, "Water Chemistry." The applicant stated that the purpose of the Water Chemistry Program is to control certain water chemistry control parameters and identify any actions required if these parameters exceed the plant limits. The applicant further stated that it uses the EPRI BWRVIP-130, "BWR Water Chemistry Guidelines," as the basis for the plant's water chemistry control. The applicant stated that the Water Chemistry Program establishes the plant water chemistry specifications, action levels, and responses to out-of-specification water chemistry conditions. The applicant stated that the EPRI Water Chemistry Guidelines defines the water chemistry control for the reactor water system and the feedwater, condensate, and hotwell system. The applicant stated that the One-Time Inspection Program is used to verify the effectiveness of the Water Chemistry Program in mitigating aging of select components. Furthermore, the applicant stated that the Water Chemistry Program is relied on for the BWR SCC Program, BWR Penetrations Program, BWR Vessel ID Attachment Welds Program, ASME Section XI Inservice Inspection, IWB, IWC, IWD Program, and BWRVIP.

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

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M2. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M2, with the exception of the "parameters monitored/inspected," and "monitoring and trending" program elements. For these elements, the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

During its audit, the staff noted that the applicant does not monitor the condensate's dissolved oxygen concentration, when the EPRI BWR Water Chemistry Guidelines indicate that it should be monitored. By letter dated September 14, 2009, the staff issued RAI B.3.39-1 requesting that the applicant provide additional information to justify why the condensate's dissolved oxygen concentration is not monitored in its program as suggested in the EPRI BWR Water Chemistry Guidelines.

In its response dated October 13, 2009, the applicant stated it has determined that sampling for condensate dissolved oxygen should be implemented and procedure changes have been initiated to continue once-per-day condensate sampling for dissolved oxygen concentration.

Based on its review, the staff finds the applicant's response to RAI B.3.39-1 acceptable, because the applicant's procedures will be revised to continue once-per-day condensate sampling for dissolved oxygen concentration, consistent with GALL AMP XI.M2 and the guidelines in the EPRI BWR Water Chemistry Guidelines. The staff's concern described in RAI B.3.39-1 is resolved.

During its audit, the staff noted that the applicant claims consistency with the "monitoring and trending" program element of GALL AMP XI.M2, however, the applicant does not increase the sampling rate when corrective actions are taken to address an abnormal chemistry condition. By letter dated September 14, 2009, the staff issued RAI B.3.39-2 requesting the applicant provide additional information to justify why an exception is not taken from the recommendations of GALL AMP XI.M2, when the applicant's documentation states it will not increase sampling due to an abnormal chemistry condition.

In its response dated October 13, 2009, the applicant stated that specific procedural guidance for increased sampling due to abnormal chemistry conditions is appropriate. Therefore, the applicant has revised its Water Chemistry Guidelines procedure to add guidance that will increase the sampling rate due to an abnormal chemistry condition.

Based on its review, the staff finds the applicant's response to RAI B.3.39-2 acceptable because the applicant's revision to its Water Chemistry Guidelines procedure (i.e., to increase the sampling rate due to an abnormal chemistry condition) is consistent with the recommendations of GALL AMP XI.M2. The staff's concern described in RAI B.3.39-2 is resolved.

As the LRA indicates, the Water Chemistry Program is used to confirm the effectiveness of various other AMPs. The staff confirmed that if an abnormal condition occurs in the Water Chemistry Program, the other programs that rely upon the Water Chemistry Program will be examined through the applicant's root cause process.

Based on its audit, and review of the applicant's response to RAI B.3.39-1 and RAI B.3.39-2, the staff finds that elements one through six of the applicant's Water Chemistry Program, are consistent with the corresponding program elements of GALL AMP XI.M2 and are, therefore, acceptable.

Operating Experience. LRA Section B.3.39 summarizes operating experience related to the Water Chemistry Program. The applicant provided two examples of site-specific operating experience to demonstrate effectiveness of its program as follows:

(1) The applicant stated that, on January 31, 2003, a high solution conductivity was indicated in the condenser hotwell, reactor feedwater, and reactor coolant solutions. The conductivity levels continued to rise resulting in an insertion of a manual reactor

scram at 50 percent power. The reactor coolant chemistry continued to degrade after the reactor scram until the main circulating water system and condensate and feedwater systems were secured. The conductivity excursion was related to the failure of a condenser tube.

(2) The applicant stated that, in March 2007, a significant degradation of the reactor water chemistry occurred; the plant was promptly shut down. The root cause was due to intrusion of condenser demineralizers into the condensate system.

In addition to these examples, the staff reviewed the applicant's operating experience provided in the applicant's program basis document, and from the applicant's selected corrective action reports related to its program.

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

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

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

<u>UFSAR Supplement</u>. LRA Section 18.1.39 provides the UFSAR supplement for the Water Chemistry Program. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.1-2, 3.2-2, 3.3-2, 3.4-2, and 3.5-2.

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

<u>Conclusion</u>. On the basis of its audit and review of the applicant's Water Chemistry Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.27 Environmental Qualification Program

Summary of Technical Information in the Application. LRA Section B.4.1 describes the existing EQ Program as consistent with GALL AMP X.E1, “Environmental Qualification (EQ) of Electrical Components.” The applicant stated that the program includes electrical and instrumentation and controls (I&C) components required to operate during and after a DBE and that are in a harsh environment during and after a DBE. The applicant stated that the EQ program manages the effects of aging by meeting the requirements of 10 CFR 50.49. The applicant incorporated TLAA option 10 CFR 54.21(c)(1)(iii) where the existing EQ program is viewed as a TLAA for license renewal and will adequately manage aging of EQ of equipment for the period of extended operation. The applicant stated that reanalysis of an aging evaluation to extend the qualification of components under 10 CFR 50.49(e) is performed on a routine basis as part of an EQ program. The applicant also stated reanalysis addresses attributes of analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, corrective actions if acceptance criteria is not met, and the period of time prior to the end of qualified life when the reanalysis will be completed. The applicant further stated that qualified life is determined for equipment within the scope of the program and appropriate actions such as replacement or refurbishment are taken prior to the end of qualified life so that aging limits are not exceeded. The applicant concluded that the EQ program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the CLB for the period of extended operation.

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

The staff compared elements one through six of the applicant’s program to the corresponding elements of GALL AMP X.E1. As discussed in the Audit Report, the staff confirmed that each element of the applicant’s program is consistent with the corresponding element of GALL AMP X.E1. Based on its audit, the staff finds that elements one through six of the applicant’s EQ Program are consistent with the corresponding program elements of GALL AMP X.E1 and are, therefore, acceptable.

Operating Experience. LRA Section B.4.1 summarizes operating experience related to the EQ Program. The applicant stated that the program incorporates industry and plant-specific operating experience to provide added assurance that aging effects are managed such that these components will continue to perform their intended functions throughout the period of extended operation. The staff reviewed the operating experience described in LRA Section B.4.1, the applicant’s basis document, and interviewed the applicant’s technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. Operating experience data included the disposition of condition reports, industry experience, and regulatory information (i.e., INs, bulletins, and GLs). The operating experience identified in LRA Section B.4.1 and the applicant’s basis documents demonstrates that, where appropriate, corrective actions are identified and implemented to ensure EQ program effectiveness. The applicant referenced two EQ program assessments dated 2004 and 2008. The 2004 Nuclear Oversight Observation Report concluded that the EQ program was satisfactory with opportunities for improvement. The 2008 Nuclear Oversight Assessment concluded that the EQ program corrective action implementation was satisfactory, the EQ related action requests and operating experience were addressed and, that overall, the EQ program was performing in a satisfactory manner.

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

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

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

UFSAR Supplement. LRA Section 18.2.1 provides the UFSAR supplement for the EQ Program. The staff reviewed this UFSAR supplement description of the program against the recommended program as described in SRP-LR Section 4.4, "Environmental Qualification of Electrical Equipment."

The staff noted that LRA Section 18.2.1 under LRA Appendix A, Section 18.2, "TLAA Evaluation of Aging Management Programs Under 10 CFR 54.21(c)(1)(iii)," states that the EQ program is consistent with 10 elements of GALL X.E1 and takes no exception to GALL AMP X.E1, but does not include reanalysis attributes consistent with the program description of LRA Section B.4.1 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). Although reanalysis attributes are not included in LRA Section 18.2.1, the staff notes that reanalysis attributes are included in TLAA UFSAR supplement in LRA Appendix A, Section 18.3.3.1, consistent with the program description of LRA Section B.4.1, LRA Section 4.4 and SRP-LR Table 4.4.2. Based on its review, the staff finds the applicant's UFSAR supplements in LRA 18.2.1 and 18.3.3.1 taken together are consistent with SRP-LR Table 4.4.2.

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

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

3.0.3.2 AMPs Consistent with the GALL Report with Exceptions or Enhancements

In LRA Appendix B, the applicant stated that the following AMPs are, or will be, consistent with the GALL Report, with exceptions or enhancements:

- BWR Reactor Water Cleanup System Program
- BWR Vessel Internals Program
- External Surfaces Program
- Fire Protection Program
- Fire Water System Program
- Fuel Oil Chemistry Program
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program
- Lubricating Oil Analysis Program
- Metal-Enclosed Bus Program
- Reactor Vessel Surveillance Program
- Structures Monitoring Program
- Metal Fatigue of Reactor Coolant Pressure Boundary Program

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 indeed consistent. The staff also reviewed the exception(s) and/or enhancement(s) to the GALL Report to determine whether they were acceptable and adequate. The results of the staff's audits and reviews are documented in the following sections.

3.0.3.2.1 BWR Reactor Water Cleanup System Program

Summary of Technical Information in the Application. LRA Section B.3.11 describes the existing BWR Reactor Water Cleanup System Program as consistent with GALL AMP XI.M25, "BWR Reactor Water Cleanup System." The applicant stated that the program manages the aging effects of cracking due to SCC or IGSCC in the reactor water cleanup (RWCU) pipe welds. The applicant also stated that no inspection is required because the screening criteria, which are specified by GALL AMP XI.M25, have been satisfied. The applicant further stated that the Water Chemistry Program is maintained in accordance with applicable BWRVIP and EPRI guidelines to minimize the potential of cracking due to SCC or IGSCC.

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

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M25. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M25 with the exception of the "scope of the program," "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program elements. For these program elements, the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

LRA Section B.3.11 states that the program includes the RWCU stainless steel pipe welds between the reactor and the second containment isolation valve and inspections of the appropriate welds outboard of the second isolation valve. In contrast, LRA Table 3.3.2-24 for the AMR of the RWCU components indicates that the BWR SCC Program, Water Chemistry Program, and ASME Section XI Inservice Inspection Program are credited to manage the effects of SCC in ASME Code Class 1 components such as flow element, pipe fittings and tubing, and valve.

The staff noted that the program description of GALL AMP XI.M25, "BWR Reactor Water Cleanup System," states that based on NRC criteria related to inspection guidelines for RWCU piping welds outboard of the second isolation valves, the program includes the measures delineated in NUREG-0313, Revision 2, and NRC GL 88-01. The staff also noted that the "scope of the program" program element of GALL AMP XI.M25 describes the screening criteria that determines the inspection schedule for the RWCU piping outboard of the second isolation valves. The staff also noted the detailed inspection schedules for the RWCU welds outboard of the second isolation valves are described in the "parameter monitored or inspected" program element. In comparison, the program description and the applicant's program basis documents state that its program includes the pipe welds between the reactor and the second containment isolation valve (inboard portion) as well as the outboard portion. By letter dated September 14, 2009, the staff issued RAI B.3.11-3 requesting that the applicant clarify what portions of the RWCU piping and piping welds are included in its program to manage the effects of SCC. The staff also requested the applicant to describe other programs that are credited to manage the effects of SCC in the RWCU piping inboard of the second isolation valves, if applicable

In its response dated October 13, 2009, the applicant stated that the portions of the RWCU piping extending from the reactor coolant recirculation system, up to and including the containment isolation valves, are managed consistent with Table IV.C1 of the GALL Report and the programs credited to manage the effects of SCC in the reactor coolant pressure boundary (RCPB) components are in accordance with the ASME Code Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program, the Water Chemistry Program, the BWR SCC Program, and the ASME Code Class 1 Small-Bore Piping Inspection Program. The staff finds that the applicant clarified that the Class 1 components (inboard portion) of the RWCU system are managed for SCC in a consistent manner with the recommendations of the GALL Report. In addition, the applicant stated that the following sentence is deleted from LRA Section B.3.11.1, "This program includes the RWCU stainless steel pipe welds between the reactor and the second containment isolation valve." The staff finds that the deletion of this sentence from the program description confirms that only the outboard portion of the RWCU piping and welds are included in the program scope and the applicant's program scope is consistent with the GALL Report.

Based on its review, the staff finds the applicant's response to RAI B.3.11-3 acceptable because the applicant clarified that: (1) SCC or IGSCC in the RWCU piping and welds outboard of the second isolation valves is managed by the BWR Reactor Water Cleanup System

Program and (2) SCC or IGSCC in the inboard portion of the RWCU piping and welds is managed by the programs that are recommend in the GALL Report, as described above. The staff's concern described in RAI B.3.11-3 is resolved.

The staff reviewed a letter from the NRC to the Iowa Electric Light and Power Company, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping," dated May 31, 1990. The staff noted that this letter indicated that the applicant's RWCU system had 81 nonsafety-related outboard piping welds, which were categorized as IGSCC Category G. The staff noted that in accordance with GL 88-01, IGSCC Category G welds are the welds made of non-resistant material and not inspected.

The staff also noted that GALL AMP XI.M25 recommends inspection Schedule A, B or C depending on the applicant's satisfactions of the screening criteria for the RWCU piping outboard of the second isolation valves. The staff noted that the screening criteria include: (a) satisfactory completion of all actions requested in NRC GL 89-10, (b) no detection of IGSCC in RWCU welds inboard of the second isolation valves (ongoing inspection in accordance with GL 88-01), and (c) no detection of IGSCC in RWCU welds outboard of the second isolation valves after inspecting a minimum of 10 percent of the susceptible piping.

Based on the screening criteria, GALL AMP XI.M25 recommends the following inspection schedules:

- *Schedule A:* No inspection is required for plants that meet all three criteria set forth above, or if they meet only criterion (a). Piping is made of material that is resistant to IGSCC.
- *Schedule B:* For plants that meet only criterion (a): Inspect at least 2 percent of the welds or two welds every RFO, whichever sample is larger.
- *Schedule C*: For plants that do not meet criterion (a): Inspect at least 10 percent of the welds every RFO.

During its audit, the staff noted that the LRA and the applicant's program basis document does not clearly describe what inspections are performed on the piping outboard of the second isolation valves in terms of inspection extent and frequency. By letter dated September 14, 2009, the staff issued RAI B.3.11-2 requesting that the applicant clarify what inspections are performed on the outboard piping in terms of inspection extent and schedule and clarify whether all IGSCC Category G welds, which were described in the foregoing reference (U.S. NRC Letter dated May 31, 1990), were replaced with materials resistant to IGSCC. The staff also requested that the applicant describe which screening criteria described in GALL AMP XI.M25 are met and provide the technical basis of the applicant's evaluation. The staff further requested that the applicant clarify which schedule of the GALL AMP XI.M25 (Schedule A, B, or C) is relevant for the outboard piping welds of the RWCU system, and confirm whether the determination of the inspection schedule is consistent with the operating experience with a corrective action addressed in RAI B.3.11-1. The staff's review and evaluation of RAI B.3.11-1 are discussed below as part of the evaluation of operating experience.

In its response dated October 13, 2009, the applicant stated that it has implemented plant modifications to eliminate IGSCC susceptible material that is exposed to temperatures equal to or greater than 140 °F except for short pieces of vendor supplied pipe and welds between heat exchangers and the short pieces of non-resistant pipe that are categorized as IGSCC Category Class D (IGSCC Category D: non-resistant, no stress improvement). The applicant also stated that all the Category G welds were replaced as part of the plant modifications. The applicant further stated that accessible portions of the short pieces of non-resistant pipe between the heat exchangers were inspected and found to be free of IGSCC and SCC. In addition, the applicant stated that the applicant's inspection schedule for the RWCU system outboard piping is Schedule A, and inspections of the piping and welds, which are located outside of the second isolation valve and are made of resistant materials, are not required and are not performed.

By letter dated December 14, 2009, the applicant further clarified its response to RAI B.3.11-2 by stating that it is classified as an inspection Schedule A plant for the purpose of scheduling inspections under its program and it has been concluded that the program description in LRA Section B.3.11 should be revised to reflect this inspection schedule and to remove the exception that was previously identified.

The staff reviewed the applicant's program, as amended by letter dated December 14, 2009, and finds the applicant's technical basis to justify no IGSCC inspections on the outboard piping and welds is acceptable because: (1) the applicant has satisfactorily completed all actions requested in NRC GL 89-10, (2) the plant modifications replaced the RWCU system piping with IGSCC-resistant material, except for the short pieces of vendor supplied pipe between the heat exchangers, and (3) the inspections of 10 percent of the non-resistant piping during each of RFOs 14 and 15 indicated no observation of SCC or IGSCC.

Based on its review, the staff finds the applicant's response to RAI B.3.11-2 acceptable because the response clarified that the applicant met the screening criteria for Schedule A in accordance with GALL AMP XI.M25. The staff's concern described in RAI B.3.11-2 is resolved.

The staff noted that LRA Section B.3.11 originally identified an exception to the "scope of the program," "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" program elements. The applicant stated that its program implements the inspection requirements of GL 88-01 as modified by BWRVIP-75, which specifies an inspection frequency that differs from the requirements given in GL 88-01. The staff's concern described in RAI B.3.11-2 is resolved.

Based on its review of the applicant's response to RAI B.3.11-2 and RAI B.3.11-3 and the technical information related to the previously identified exception, the staff noted that the program scope does not include the inboard piping, the inspection schedule is based on the screening criteria for the outboard piping, and ongoing GL 88-01 inspections are performed on the inboard piping within the scope of the BWR SCC Program. The staff further noted that this exception, which the applicant identified due to the inspection frequency modified by BWRVIP-75, does not affect the applicant's RWCU System Program because the outboard piping inspection schedule is in accordance with the recommendations in GALL AMP XI.M25, and are not based on BWRVIP-75 or GL 88-01.

By letter dated December 14, 2009, the applicant amended its LRA to remove this exception and confirmed that based on the response to RAI B.3.11-2 the program description should be revised to reflect the Schedule A inspection and to remove this identified exception. The staff determines that the applicant's removal of this exception is acceptable because: (1) the program scope does not include the inboard piping, (2) the inspection schedule is based on the screening criteria for the outboard piping that is described in GALL AMP XI.M25, and (3) ongoing GL 88-01 inspections are performed on the inboard piping within the scope of the BWR SCC Program.

Based on its audit and review of the applicant's responses to RAIs B.3.11-2 and B.3.11-3, the staff finds that elements one through six of the applicant's BWR Reactor Water Cleanup System Program, are consistent with the corresponding program elements of GALL AMP XI.M25 and are, therefore, acceptable.

Operating Experience. LRA Section B.3.11.5 summarizes operating experience related to the BWR Reactor Water Cleanup System Program. In its response to RAI B.3.11-1, by letter dated October 13, 2009, as addressed above, the applicant stated that LRA Section B.3.11.5 is revised in its entirety to read as follows:

> The DAEC Reactor Water Cleanup System Program has been effective in managing the aging effects of cracking due to SCC or IGSCC in the RWCU piping. The program incorporates both industry and plant specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to maintain their intended functions throughout the period of extended operation.
>
> DAEC has implemented plant modifications to eliminate the IGSCC susceptible material that is exposed to temperatures equal to or greater than 140 °F except for short pieces of vendor supplied pipe and welds between heat exchangers. The short pieces of non-resistant pipe are categorized as IGSCC Category Class D.

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

In its review of the foregoing description of the operating experience, the staff finds that the AMP, which incorporated plant modifications to eliminate IGSCC susceptible material, is an acceptable and effective method to manage the aging effects due to SCC or IGSCC in the RWCU piping. The staff also finds that the plant modifications in consideration of the temperature threshold for SCC (greater than or equal to 140 °F) are consistent with the GALL Report.

However, during its audit, the staff noted that a corrective action was performed on June 28, 1994 to perform a weld repair. Based on the corrective action regarding the weld repair, the staff found a need to further clarify how the corrective action was closed and how effective its program has been in detecting and managing the effects of SCC in the RWCU system.

By letter dated September 14, 2009, the staff issued RAI B.3.11-1 requesting that the applicant clarify whether the weld repair is related to the occurrence of SCC in the RWCU system and describe the location of the weld (for example, inboard or outboard of the second isolation valve). The staff also requested that, if applicable, the applicant describe how the weld was repaired and clarify whether an additional SCC indication has been observed in the repaired weld. Furthermore, the staff requested that the applicant describe how effective its program has been in detecting and managing the SCC in the RWCU system.

In its response dated October 13, 2009, the applicant stated that the repair welding was performed to replace a 3-inch long by ¾-inch Type 304 stainless steel pipe nipple located outboard of the second isolation valve; the cause of the leaking was most likely due to IGSCC. The applicant also stated that the replacement of the pipe nipple was due to the short length of the nipple and the material being non-resistant to IGSCC. The short pipe nipple was replaced with a longer, Type 304L stainless steel nipple so that the two welds are at least 4 inches apart. The applicant further confirmed that since the replacement, the longer Type 304L stainless steel nipple has not failed.

The staff finds that the pipe nipple that experienced leaking had a small diameter of ¾ inch and is not included in the program scope in accordance to GL 88-01 that is intended to manage IGSCC for the austenitic stainless piping that is 4 inches or larger in nominal diameter. The staff also finds that the major contributing factors for the leaking were the non-resistant material, which was not a low carbon stainless steel, and the short length of the nipple, which was a design issue, that increased the tensile stress in the pipe nipple.

Based on the information the applicant provided, the staff finds that the replacement of the nipple with the longer and resistant material is adequate to manage IGSCC in accordance with the recommendations in GL 88-01; and the operating experience, with no repeat failure since the replacement, also supports the adequacy of the applicant's corrective action and aging management to prevent IGSCC. Since one of the major contributing factors for the potential IGSCC occurrence is a design issue (short length) of the specific pipe nipple, the staff finds that the observation of the potential IGSCC occurrence does not necessarily imply that SCC or IGSCC is an active degradation mechanism in the RWCU system that can cause significant adverse effects on the intended functions of the components in the RWCU system.

In its response to RAI B.3.11-1, the applicant also stated that after the plant modifications to eliminate IGSCC-susceptible material exposed to temperatures equal to or greater than 140 °F, accessible portions of the short pieces of non-resistant pipe were inspected and found to be free of IGSCC and SCC. The applicant also clarified that after completing the pipe replacement, the hydrostatic test revealed leakage in the inner radius of a bend in the piping which had been difficult to inspect due to contour and surface condition causing non-optimum contact of the transducer; analysis showed the indication was not related to IGSCC. The applicant further stated that the defective pipe was replaced and tested satisfactorily and additional RWCU pipes of the same configuration were re-examined to assure no other similar defects existed; no additional cracking has been observed.

In its review, the staff finds that the inspections on the non-resistant piping and hydrostatic testing confirmed that the inspected and tested piping had no indication of IGSCC or SCC and the operating experience also supports that the applicant's AMP has been effective to manage IGSCC and SCC in the RWCU system piping within the program scope.

Based on its review, the staff finds the applicant's response to RAI B.3.11-1 acceptable because the applicant's response clarified that: (1) the failed component (short pipe nipple) was not within the scope of the program and (2) the failure resulted from design issues (short length and use of a non-resistant material). The staff's concern described in RAI B.3.11-1 is resolved.

By letter dated December 14, 2009, the applicant also amended LRA Section B.3.11.5 to add and clarify that during RFOs 14 and 15, 10 percent of the Category D welds were inspected during each outage and no indication of IGSCC has been observed. The applicant also clarified that the failure of the 3-inch long ¾-inch pipe nipple was attributed to a specific fabrication deficiency.

Based on its review, the staff finds that the revision to LRA Section B.3.11.5, by letter dated December 14, 2009, is acceptable because the revision of the operating experience adequately addresses: (1) the inspection results of the non-resistant welds that justify the application's determination of the inspection schedule for the RWCU outboard piping in accordance with GALL AMP XI.M25 and (2) the relevant root cause and corrective action for the failure at the 3-inch long ¾-inch pipe nipple.

Based on its audit and review of the application, and review of the applicant's response to RAI B.3.11-1, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

UFSAR Supplement. LRA Section 18.1.11 provides the UFSAR supplement for the BWR Reactor Water Cleanup System Program. By letter dated December 14, 2009, the applicant amended LRA Section 18.1.11 to reflect the revised program description. The staff reviewed this UFSAR supplement description of the program against the recommended description for this type of program as described in SRP-LR Table 3.1-2.

The staff noted that the applicant's UFSAR supplement does not clearly indicate whether the program includes measures delineated in NUREG-0313, Revision 2, and NRC GL 88-01. By letter dated January 14, 2010, the applicant amended LRA Section 18.1.11 to clearly identify that measures from NUREG-0313, Revision 2, and NRC GL 88-01 are included in its program. The staff notes that the UFSAR supplement, as amended by letter dated January 14, 2010, conforms to the recommended description for this type of program as described in SRP-LR Table 3.1-2.

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

Conclusion. On the basis of its audit and review of the applicant's BWR Reactor Water Cleanup System Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff concludes, that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes, that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.2 BWR Vessel Internals Program

Summary of Technical Information in the Application. LRA Section B.3.14 describes the existing BWR Vessel Internals Program with enhancements that are consistent with GALL AMP

XI.M9, “BWR Vessel Internals.” The applicant stated that this program includes inspection, flaw evaluation and repair guidelines that are consistent with the guidelines addressed in relevant BWRVIP reports. The applicant reiterated that this AMP monitors aging effects due to SCC, IGSCC and irradiation-assisted stress corrosion cracking (IASCC). The applicant further stated that the water chemistry guidelines are consistent with GALL AMP XI.M2, “Water Chemistry Program.” DAEC implanted its ISI program consistent with the ASME Code Section XI, 2001 Edition through 2003 Addenda. The applicant further stated that the BWR Vessel Internals Program is consistent with the GALL AMP XI.M9, “BWR Vessel Internals,” 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 implementation of EVT-1 of 5 percent of the top guide locations that were already exposed to a neutron fluence value greater than the IASCC threshold value of 5×10^{20} n/cm^2 (E is greater than 1 million electron volts [MeV]) within 6 years after entering into the extended period of operation. An additional 5 percent of the top guide locations will be inspected within twelve years after entering the period of extended operation.

Staff Evaluation. During its audit, 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 per the BWRVIP reports or ASME Code Section XI requirements. 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 the staff finds it acceptable because the GALL Report allows the use of a later revision of the BWRVIP report for monitoring RCS water chemistry.

Regarding the enhancement to GALL AMP XI.M9, the staff reviewed the applicant’s proposal for the implementation of inspection requirements for the top guide grid beams and accepts it because the proposed inspection criteria are consistent with GALL AMP XI.M9.

To verify that the applicant is adequately managing the degradation in the RVI components, the staff issued several RAIs (addressed below) requesting that the applicant provide information regarding the RCS water chemistry, past inspections, results of the inspections, and corrective actions that were taken as part of the AMP to prevent any recurrence of any aging degradation in the RVI components.

In a letter dated September 24, 2009, the staff issued RAI-B.3.14-1, requesting that the applicant confirm whether it is incorporating HWC and/or NMCA in its Water Chemistry Program. The staff also requested that the applicant explain how the implementation of HWC has affected the plant chemical parameters and to provide details on the methods for determining the effectiveness of HWC and/or NMCA by using the following parameters:

(1) electrochemical potential (ECP); (2) feedwater hydrogen flow; (3) main steam line oxygen content, and (4) hydrogen/oxygen molar ratio. If ECP is measured to verify the effectiveness of HWC and/or NMCA, the applicant is requested to provide information regarding the locations at which the ECP measurements are taken. By letter dated October 23, 2009, the applicant provided a response which indicates that the implementation of HWC/NMCA is monitored by: (1) ECP measurements taken with an ECP sensor located at B loop reactor recirculation riser via the reactor recirculation sample valves; (2) monitoring feedwater hydrogen flow; (3) monitoring main steam line oxygen content; and (4) maintaining hydrogen-oxygen molar ratio of four. The staff reviewed the response and determined that the applicant’s monitoring of the

HWC/NMCA program complies with the program developed by the BWRVIP group. The staff, in principle, agreed with the application of this program. The effective monitoring methodology adopted by the applicant will ensure the effectiveness of HWC/NMCA program at DAEC and, therefore, the staff accepts the applicant's response and considers that its concerns related to RAI-B.3.14-1 are resolved.

In a letter dated September 24, 2009, the staff issued RAI-B.3.14-2, requesting that the applicant address the type of prior inspections that were performed on the inaccessible welds in core spray systems as required by Table 3-5 of the BWRVIP-18-A report. The staff also requested that the applicant address the inspection results and any corrective actions that were taken so far to prevent recurrence of any aging degradation of these welds. By letter dated October 23, 2009, the applicant stated that the P1 welds are inaccessible and the inspection requirements and corrective actions for these welds are based on the extent to which any aging degradation was detected in similar welds (P2, P3, P5, P6, P7, P8a, and P8b) that are accessible for inspection. These accessible welds were inspected using EVT-1 and no recordable indications or cracking were detected; hence, no corrective actions were taken. The staff reviewed the applicant's response and determined that since the past inspection data on similar welds that are accessible for inspection showed no active aging degradation, it is reasonable to conclude that there is no active aging degradation in the P1 welds. Additionally, the accessible welds in the core spray system will be inspected per the BWRVIP-18-A inspection guidelines during the extended period of operation, which will enable the applicant to effectively monitor the aging degradation in these welds. Therefore, the staff accepts the applicant's response and considers that its concerns related to RAI-B.3.14-2 are resolved.

Regarding the aging degradation in the core plate component, the staff was concerned with respect to aging degradation in core plate plugs. In that context, by letter dated September 24, 2009, the staff issued RAI B.3.14-3, requesting that the applicant identify the type of core plate plugs used in DAEC vessel, the type of inspections performed, results of the inspections, and corrective actions taken to prevent recurrence of any aging degradation. In its response, by letter dated October 23, 2009, the applicant stated that the core plate plugs are spring loaded and these plugs are replaced per the General Electric (GE) recommendation, and based on GE's recommendation, the subsequent replacement of these plugs is expected to occur in 2012 or 2014. The staff accepts this response because the applicant, in lieu of performing frequent inspections, adopts replacement as an aging management strategy. Therefore, the staff considers that its concerns related to RAI-B.3.14-3 are resolved.

To ensure that the aging degradation in the following RVI components is adequately monitored, by letter dated September 24, 2009, the staff issued RAI-B.3.14-4, requesting that the applicant identify which of the following RVI components exhibited cracking, the corrective actions taken, and any additional augmented inspections implemented as part of corrective actions: (A) core spray system; (B) core plate; (C) steam dryer; (D) top guide; (E) CRD guide tube, stub tube, in-core housing and dry tube; and (F) reactor vessel penetrations.

In a letter dated October 23, 2009, the applicant stated that cracking was identified in the steam dryer and dry tubes. Cracking in the steam dryer was monitored by performing inspections per the BWRVIP-139 report and by conducting an engineering evaluation. The applicant repaired the steam dryer component based on the results from its flaw evaluation, and will continue to perform inspections per the staff-approved BWRVIP-139 report. The staff accepts this response because of the applicant's compliance with the inspection guidelines specified in the BWRVIP-139 report, and because of the applicant's decision to perform repairs as required by its flaw evaluation and the corrective action programs. Regarding the aging degradation in dry tubes, the applicant replaced two dry tubes with tubes with a modified design, and thus far, no cracking was observed in the replaced tubes. The staff accepts this response because by implementing frequent inspections as required by BWRVIP-47-A, and by performing replacement of the dry tubes, the applicant has demonstrated its capability of effectively managing the aging effects in dry tubes. Therefore, the staff considers that its concerns related to RAI-B.3.14-4 are adequately resolved.

In a letter dated September 24, 2009, the staff issued RAI B.3.14-5 (A) through (D), requesting that the applicant identify which core shroud welds showed indications during previous inspections, and discuss tie rod repairs, if any, that were performed at DAEC. By letter dated October 23, 2009, the applicant provided its response.

In response to RAI B.3.14-5 (A), the applicant stated that inspections performed thus far on the core shroud horizontal welds (i.e., H1 though H7) did not show any indications, and that DAEC thus far has no core shroud tie rod repairs. The staff reviewed this response and determined that even though there is no active aging degradation in these welds, continued inspections of these welds per the BWRVIP-76 report will identify any aging degradation in a timely manner during the extended period of operation.

In response to RAI B.3.14-5 (B), the applicant included Commitment Number 46 which requires the use of fracture toughness values from the BWRVIP-100-A report for the core shroud components that are exposed to a neutron fluence values equal to or greater than 1×10^{21} n/cm^2 (E being greater than 1 MeV). The staff accepts this response because the application of the staff-approved fracture toughness values from the BWRVIP-100-A report as a part of the flaw evaluation in core shroud welds ensures the structural integrity of the welds.

In response to RAI B.3.14-5 (C), the applicant stated that it will consider Hatch, Unit 1, cracking issues as a part of a tie rod repair strategy if such repair is warranted during the license renewal period.

In response to part 1 of RAI B.3.14-5 (D), the applicant stated that identification of aging effects due to pitting and general corrosion in the core shroud welds will be managed by implementing the ASME Section XI Inservice Inspection Program. The staff accepts this response as it complies with GALL AMP XI.M9.

In response to part 2 of RAI B.3.14-5 (D), the applicant stated that the CLB does not include any fatigue evaluation for the core shroud welds and, therefore, the applicant determined that fatigue evaluation as a part of TLAA for the shroud component is not required. The staff accepts this response because the applicant, consistent with the GALL AMP XI.M9, made a commitment to implement the inspection requirements specified in the BWRVIP-76 report as a part of an AMP.

Based on the above review, the staff determined that its concerns related to RAI-B.3.14-5 (A) through (D) are adequately resolved.

In a letter dated September 24, 2009, the staff issued RAI B.3.14-6(A) requesting that the applicant identify cracking of the jet pump components at DAEC. By letter dated October 23, 2009, the applicant stated that cracking was observed in restrainer set screw tack welds to several jet pumps and the applicant modified the repair by adding two tack welds to all restrainer set screws and no cracking was found thereafter. The staff accepts this response because the applicant is in compliance with the inspection criteria specified in the BWRVIP-41 report which will enable the applicant to effectively monitor the cracking in jet pump components during the license renewal period. In a letter dated September 24, 2009, the staff issued RAI B.3.14-6(B) requesting that the applicant address how the aging effects in jet pump thermal sleeve welds (inaccessible for inspection) are monitored. By letter dated October 23, 2009, the applicant stated that it did not inspect these welds (TS-1 and TS-2), and a plant-specific consequence analysis indicated that if these welds fail, the riser pipe will contact the shroud prior to the disengagement of the thermal sleeve from the nozzle. The applicant, however, performed EVT-1 (with limited coverage) on additional welds (TS-1A) which are 1 inch away from the thermal sleeve-to-riser elbow weld, and three out of eight of these welds showed no indication of cracking. The applicant also claimed protection from HWC in the TS welds. Even though there was limited inspection coverage in TS-1A welds, it is reasonable to conclude that, absent any cracking in the TS-1A welds, there is no active aging degradation (at present) in the TS-1 and TS-2 welds. The staff accepts the response because the applicant intends to inspect the TS-1 and TS-2 welds with an improved inspection technique when it is developed by the BWRVIP. Based on the review, the staff determined that its concerns related to RAI-B.3.14-6(A) and (B) are adequately resolved.

In a letter dated September 24, 2009, the staff issued RAI B.3.14-7 requesting that the applicant address augmented inspection of access hole covers which is required in accordance with the requirements of GALL AMR item IV-B.1.1-d. By letter dated October 23, 2009, the applicant stated that in addition to the routine inspections per the ASME Section XI Inservice Inspection Program, the applicant intends to perform augmented UT examinations on the access hole covers. The applicant will also comply with the BWR water chemistry guidelines as part of AMP for the access hole covers. The staff accepts this response because it complies with GALL AMR line item IV-B.1-d. The staff determined that its concerns related to RAI-B.3.14-7 are adequately resolved.

SCC could occur in the BWR reactor vessel flange leak detection line. In accordance with the requirements of GALL Report, Table IV, item A1.1.5, a plant-specific AMP is to be evaluated for this component. In LRA Appendix C, the applicant stated that the AMP for this item will include implementation of BWR water chemistry and a one-time inspection. The staff determined that the one-time inspection is not adequate to identify cracking due to SCC in a timely manner. Hence, in a letter dated September 24, 2009, the staff issued RAI B.3.14-8 requesting that the applicant provide justification for using a one-time inspection as a part of the AMP for managing this aging effect in the reactor vessel flange leak detection line. By letter dated October 23, 2009, the applicant stated that at DAEC, carbon steel is used for the reactor vessel flange leak detection line and, therefore, it is not subject to IGSCC/SCC. However, in LRA Appendix C, the applicant stated that it will perform a one-time inspection and implement BWR water chemistry as part of AMP to monitor loss of material in reactor vessel flange leak detection line. The staff accepts the applicant's inspection strategy and considers that absent IGSCC/SCC as active aging degradation, the applicant's proposed AMP is adequate to monitor the aging effect in the reactor vessel flange leak detection line. Therefore, the staff's concern regarding RAI B.3.14-8 is resolved.

<u>Operating Experience</u>. With respect to the plant operating experience portion of this AMP, the operating experience provided by the applicant and identified by the staff's independent database search is bounded by industry operating experience (i.e., no previously unknown aging effects were identified by the applicant or the staff). 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 the DAEC's operating experience, 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 aging degradation of the RVI components and implement proper corrective actions to restore the structural integrity of the RVI components.

License Renewal Action Items Addressed in Appendix C. The applicant made a commitment to comply with the following three license renewal action items which are listed in staff's safety evaluations for the various BWRVIP reports:

- DAEC's AMP for the RVI components is bounded by the aforementioned BWRVIP reports.
- The UFSAR supplement addresses a summary of the programs and activities specified in the applicable BWRVIP reports.
- DAEC states that no technical specification changes have been identified as a result of implementing the AMP for the RVI components.

The staff reviewed the applicant's disposition for these three license renewal action items and concludes that the applicant complied with the intent of the license renewal action items that were specified by the staff in its safety evaluations for the applicable BWRVIP reports.

According to the applicant there are no TLAA issues for DAEC related to the following BWRVIP reports, but it has committed to complying with the requirements specified in these BWRVIP reports: BWRVIP-18-A, BWRVIP-38, BWRVIP-41, BWRVIP-48-A, and BWRVIP-49-A.

The staff reviewed the applicant's response to the license renewal action items and accepted it because the staff's SEs for the aforementioned BWRVIP reports, do not specify any license renewal action items.

The applicant determined that the following BWRVIP reports contain RVI components that require TLAA evaluation: BWRVIP-25 (stress relaxation of core plate hold-down bolts), BWRVIP-26-A (IASCC of top guide grid beams), BWRVIP-27-A (fatigue of the SLC nozzle), and BWRVIP-47-A (fatigue of the lower plenum components). The staff's TLAA evaluations for these components are addressed in Section 4.0 of the staff's safety evaluation.

The license renewal action items specified in the staff's safety evaluation 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 extended period of operation. The BWRVIP-74-A report also addresses the license renewal action items associated with TLAAs for the extended period of 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 safety evaluation for the BWRVIP-74-A report, the applicant identified loss of material and cracking as aging effects that require an AMP for the vessel flange leak detection (VFLD) line. The applicant stated that it would manage these aging effects by performing a one-time inspection and by controlling the RCS water chemistry. The staff accepts the applicant's proposed AMP for the VFLD lines because: (1) carbon steel is used for the reactor vessel flange leak detection line and, therefore, it is not subject to IGSCC/SCC 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 loss of material in VFLD lines.

Item 5 of the license renewal action items in the staff's safety evaluation for the BWRVIP-74-A report requires that the applicant describe how each plant-specific AMP addresses the 10 elements listed in GALL AMP XI.M9. The applicant stated that LRA Appendix B 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 safety evaluation for the BWRVIP-74-A report requires that the applicant 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 water chemistry guidelines specified in the BWRVIP-130 report which superseded the BWRVIP-29 report. The staff accepts this response as the applicant's compliance with the requirements of the BWRVIP-130 provides adequate mitigation to the occurrence of IGSCC.

Item 7 of the license renewal action items in the staff's safety evaluation for the BWRVIP-74-A report requires that the applicant identify its RPV surveillance program. The applicant stated 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 safety evaluation for the BWRVIP-74-A report requires that the applicant should 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-A report. The applicant stated that fatigue, including discussions of cycles, projected cumulative usage factors, and environmental factors, etc., is evaluated as a TLAA in LRA Section 4.3. The staff's evaluation of this issue is addressed in Section 4.3.

Item 9 of the license renewal action items in the staff's safety evaluation for the BWRVIP-74-A report requires that a set of pressure-temperature (P-T) curves be developed for heat-up and cool-down operating conditions in the plant at a given number of effective full-power years (EFPYs) during the period of extended operation. The applicant stated that the development of P-T curves for the period of extended operation is described as a TLAA in LRA Section 4.2.3. The staff evaluated the TLAA associated with P-T curves in Section 4.2.3.

Item 10 of the license renewal action items in the staff's SE for the BWRVIP-74-A report requires that the applicant evaluate the percent of reduction in Charpy upper-shelf energy (USE) values for the beltline materials during the period of extended operation. The applicant stated that the TLAA evaluation of USE is addressed in LRA Section 4.2.1. The staff evaluated the TLAA associated with USE criteria for the RPV beltline materials in Section 4.2.1.

Item 11 of the license renewal action items in the staff's SE for the BWRVIP-74-A report requires that the applicant may obtain relief from the ISI of the RPV circumferential shell welds during the period of extended operation. The BWRVIP-05 report, "Reactor Vessel Shell Weld Inspection Guidelines," requires that each applicant demonstrates that: (1) at the end of the renewal period, the RPV circumferential shell welds will satisfy the limiting conditional failure frequency specified in Appendix E for the staff's SE 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 SE dated July 28, 1998, for the BWRVIP-05 report. The applicant stated that the discussion of the relief from the ISI of the RPV circumferential shell welds for DAEC during the period of extended operation is described in LRA Section 4.2.4. The staff evaluated the TLAA associated with the relief from the ISI of the RPV circumferential shell welds for DAEC and the staff's evaluation is addressed in Section 4.2.4.

Item 12 of the license renewal action items in the staff's SE for the BWRVIP-74-A 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 SE, dated October 18, 2001, for the BWRVIP-74-A report. The applicant stated that the TLAA evaluation of beltline RPV axial welds is addressed in LRA Section 4.2.5. The staff evaluated the TLAA associated with the RPV axial weld failure probability for DAEC in Section 4.2.5.

Item 13 of the license renewal action items in the staff's SE for the BWRVIP-74-A 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 stated that the calculation of neutron flux is addressed in LRA Section 4.2. The staff evaluated the TLAAs associated with the neutron fluence calculations in Section 4.2.

Item 14 of the license renewal action items in the staff's SE for the BWRVIP-74-A 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 license renewal term. The applicant stated that it has performed flaw evaluations for previously identified indications and they are discussed in LRA Section 4.3. The staff evaluated the TLAAs associated with the flaw evaluations in Section 4.3.

<u>UFSAR Supplement</u>. In LRA Appendix A, Section 18.1.14, the applicant provided the UFSAR supplement for the BWR Vessel Internals Program. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary description of the program (in which the applicant made a commitment to incorporate the BWRVIP inspection requirements for the RVI components), as required by 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 concluded 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, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.3 External Surfaces Monitoring Program

Summary of Technical Information in the Application. LRA Section B.3.21 describes the existing External Surfaces Monitoring Program as consistent, with enhancements, with GALL AMP XI.M36, “External Surfaces Monitoring.” The applicant stated that the program consists of periodic visual inspections of external surfaces of steel components such as piping, piping components, ducting, pipe supports, and other components for evidence of material loss. The applicant also stated that existing plant system walkdowns, tours and inspection activities are used, including inspections during shutdown conditions and joint tours with other departments (e.g., operations, maintenance), to perform the inspections for this program, using INPO 85-033, Revision 1, “Use of System Engineers” as a guideline. The applicant further stated that the walkdowns enable the system engineers to maintain an awareness of system conditions and performance.

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

The staff compared elements one through six of the applicant’s program to the corresponding elements of GALL AMP XI.M36. As discussed in the Audit Report, the staff confirmed that each element of the applicant’s program is consistent with the corresponding element of GALL AMP XI.M36, with the exception of the “scope of the program,” “detection of aging effects,” and “monitoring and trending” program elements. For these elements, the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

The applicant described the “detection of aging effects” program element to be consistent with the GALL Report with no exceptions or enhancements; however, the staff noted that in Commitment No. 8, the applicant stated that it would revise the inspection program to address aging effects along with other changes. By letter dated September 14, 2009, the staff issued RAI B.3.21-1, requesting that the applicant identify or provide the specific enhancement applicable to the “detection of aging effects” program element.

In its response dated October 13, 2009, the applicant stated that the “detection of aging effects” program element is consistent with the corresponding GALL Report program element. The applicant also stated that the term “aging effects” within Commitment No. 8 refers to enhancements for the “acceptance criteria” program element to ensure that corrective actions will be identified for all component/aging effect combinations applicable to the program.

The staff finds the applicant’s response acceptable because the explanation provides clarification on the intent of the commitment wording. The staff’s concern described in RAI-B.3.21-1 is resolved.

The staff reviewed the applicant’s program basis document and implementing procedure and noted that for the “scope of the program” program element, the basis document discusses both inaccessible areas and insulated areas; however, the staff noted that the implementing procedure does not have related details. The LRA enhancement to this program element, does not address these aspects. In GALL AMP XI.M36, the “scope of the program” program element discusses inaccessible areas that need to be inspected at some interval to provide reasonable assurance that aging effects will be managed. By letter dated September 14, 2009, the staff issued RAI B.3.21-2, requesting the applicant clarify the details of the enhancement regarding walkdowns of inaccessible areas and insulated external surfaces.

In its response dated October 13, 2009, the applicant revised the enhancement for the “scope of the program” program element to address inspections in inaccessible areas and inspections of opportunity for possible corrosion under insulation. The applicant also revised Commitment No. 8 to address inaccessible areas and inspections of opportunity for possible corrosion under insulation.

The staff finds the applicant’s response acceptable because both the enhancement and commitment were revised to address inaccessible areas and possible corrosion under insulation. The staff’s concern described in RAI-B.3.21-2 is resolved.

The staff reviewed the applicant’s program basis document and noted that it contains an exemption for inspection walkdowns for specific insulated piping having higher temperatures. By letter dated September 14, 2009, the staff issued RAI B.3.21-3, requesting the applicant provide the basis for the exclusion of insulated higher temperature piping from inspection walkdowns.

In its response dated October 13, 2009, the applicant referenced EPRI TR-1010639, “Non Class I Mechanical Implementation Guidelines and Mechanical Tools,” Appendix E, Section 2.2.1. Based on this document, the applicant stated that for external surface component temperatures in excess of 212 °F, the temperature precludes the formation of surface condensation or wetness for indoor insulated pipes. The applicant also stated that the exempted piping has operating temperatures greater than 251°F and is located indoors. The applicant further stated that leakage from plant fluid systems or attacks from accidental chemical spills on all indoor insulated pipes, at low or high temperatures, would be detected early with corrective actions followed in a timely manner. The applicant stated that: (1) low temperature insulated pipes in an indoor or outdoor environment could have wetted external surfaces due to condensation or rain water for extended periods without being detected, (2) for such pipe surfaces, inspections of opportunity would be performed, and (3) if there are insufficient opportunities for inspection, additional sample locations will be examined to assess conditions under the insulation for possible entrapment of condensation or rain water. During a phone conversation on January 14, 2010, the applicant stated that all insulated hot pipes have a surface temperature in excess of 212 °F and defined an inspection of opportunity to be cycle based on RFOs, not to exceed 2 years.

The staff finds the applicant’s responses acceptable because they provided sufficient justification for insulated indoor hot piping not to be inspected and indoor/outdoor low temperature piping will be examined through inspections of opportunity with a periodicity not to exceed 2 years. The staff’s concern described in RAI B.3.21-3 is resolved.

The staff reviewed the “monitoring and trending” program element in the applicant’s program basis document against the corresponding program element in GALL AMP XI.M36. The staff noted that the applicant’s enhancement for this program element discusses enhancing the walkdown process to more specifically address qualifications of inspection personnel and its periodic reviews to determine program effectiveness; however, the basis document does not elaborate on plant-specific instructions/checklists to be used during inspections and for trending the results of inspections. By letter dated September 14, 2009, the staff issued RAI B.3.21-4 requesting the applicant clarify the enhancement regarding the inclusion of specific instructions/checklists and other relevant procedural requirements for the program walkdowns.

In its response dated October 13, 2009, the applicant stated that it will follow the guidance issued by EPRI in TR-1009743, "Aging Identification and Assessment Checklist," dated August 27, 2004. The applicant also stated that they will use the program health process to provide periodic reviews to determine program effectiveness and trend the degradation of SSCs. The applicant further stated that through Commitment No. 8, the procedural guidance for system walkdowns credited by the program is being enhanced to more specifically address the types of components to be inspected, the relevant degradation mechanisms and effects of interest, the RFO inspection frequency, the inspections of opportunity for possible corrosion under insulation, the qualifications required for inspection personnel, and the acceptance criteria for the component/aging effect combination to be sure that corrective actions will be identified before loss of intended function.

The staff finds the applicant's response acceptable because the applicant's enhancement to the system walkdown process will address requirements such as types of components to be inspected, relevant degradation mechanisms, etc. The staff's concern described in RAI B.3.21-4 is resolved.

The staff also reviewed the portions of the "scope of the program," "parameters monitored or inspected," "monitoring or trending," and "acceptance criteria" program elements associated with enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these enhancements follows.

Enhancement 1. LRA Section B.3.21 states an enhancement to the "scope of the program" program element. The applicant stated that they will enhance the system walkdown process to more specifically address the types of components to be inspected, the relevant degradation mechanisms and effects of interest, and the RFO inspection frequency. The staff reviewed this enhancement against the corresponding program element in GALL AMP XI.M36. As discussed in RAI B.3.21-2, above, the staff noted that the applicant's implementing procedures lacked specificity and requested clarifications on the inspection of insulated components and those located in inaccessible areas. The applicant amended the enhancement as noted in the response to the RAI dated October 13, 2009. The staff finds the applicant's response acceptable because they modified the enhancement and commitment to address inaccessible areas and possible corrosion under insulation. Additionally, as discussed in RAI B.3.21-3, above, the staff reviewed the applicant's program basis document and noted that it contains an exemption for inspection walkdowns for specific insulated piping having higher temperatures. In its response dated October 13, 2009, as discussed above, the applicant provided its basis. The staff finds the applicant's response acceptable because it provided sufficient justification for indoor hot piping not being inspected and stated that low temperature piping would be inspected for aging effects by inspections of opportunity with a periodicity not to exceed an RFO interval. On the basis of its review, the staff finds this enhancement, as amended, acceptable because, when it is implemented prior to the period of extended operation, it will make the program consistent with the recommendations in GALL AMP XI.M36.

Enhancement 2. LRA Section B.3.21 states an enhancement to the "parameters monitored or inspected" program element. The applicant stated that they will enhance the system walkdown process to more specifically address the types of components to be inspected, and the relevant degradation mechanisms and effects of interest. The staff reviewed this enhancement against the corresponding program element in GALL AMP XI.M36. On the basis of its review, the staff finds this enhancement acceptable because, when it is implemented prior to the period of extended operation, it will make the program consistent with the recommendations in GALL AMP XI.M36.

Enhancement 3. LRA Section B.3.21 states an enhancement to the “monitoring and trending” program element. The applicant stated that they will enhance the system walkdown process to more specifically address the qualifications required for inspection personnel and periodic reviews to determine program effectiveness. The staff reviewed this enhancement against the corresponding program element in GALL AMP XI.M36. The staff noted that the applicant’s basis document does not elaborate on plant-specific instructions/checklists to be used during inspections and for trending the results of inspections. As discussed in RAI B.3.21-4, above, the staff requested a clarification on the enhancement regarding the inclusion of specific instructions/checklists and other relevant procedural requirements for the program walkdowns. The applicant responded to the RAI on October 13, 2009, as noted above. The applicant stated that it will follow the guidance issued by EPRI in TR-1009743, “Aging Identification and Assessment Checklist,” and will use the program health process to provide periodic reviews to determine program effectiveness and trend the degradation of SSCs. The applicant also stated that through Commitment No. 8, the procedural guidance for system walkdowns credited by the External Surfaces Monitoring Program is being enhanced. The staff finds the applicant’s response acceptable because the applicant’s enhancement to the system walkdown process will address requirements such as types of components to be inspected, relevant degradation mechanisms, etc. On the basis of its review, the staff finds this enhancement acceptable because, when it is implemented prior to the period of extended operation, it will make the program consistent with the recommendations in GALL AMP XI.M36.

Enhancement 4. LRA Section B.3.21 states an enhancement to the “acceptance criteria,” program element. The applicant stated that it will enhance the existing system walkdown process to more specifically address the acceptance criteria for the component/aging effect combination to be sure that corrective actions will be identified before loss of intended function, and to conduct periodic reviews to determine program effectiveness. On the basis of its review, the staff finds this enhancement acceptable because, when it is implemented prior to the period of extended operation, it will make the program consistent with the recommendations in GALL AMP XI.M36.

Based on its audit and review of the applicant’s responses to RAIs B.3.21-1, B.3.21-2, B.3.21-3, and B.3.21-4, the staff finds that elements one through six of the applicant’s External Surfaces Monitoring Program, with acceptable enhancements, as amended, are consistent with the corresponding program elements of GALL AMP XI.M36 and are, therefore, acceptable.

Operating Experience. LRA Section B.3.21 summarizes the operating experience related to the External Surfaces Monitoring Program. The applicant stated that the program has been effective in managing the aging effects of loss of material and incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended functions throughout the period of extended operation. The applicant also stated that the existing walkdowns have been effective in identifying corrosion or leakage in systems, citing as examples, corrosion that was found on the external surface of the turbine stop valve pipe and a steam leak from between the cap nut and steel washer on the casing stud of the feedwater pump; both examples were documented and addressed using the corrective action program.

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

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

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

UFSAR Supplement. LRA Section A.18.1.21 provides the UFSAR supplement for the External Surfaces Monitoring Program. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Tables 3.2-2, 3.3-2, and 3.4-2.

The staff also notes that the applicant committed, through Commitment No.8, to enhance the External Surfaces Monitoring Program prior to entering the period of extended operation. Specifically, the applicant committed to revise the inspection program to address inspector qualifications, types of components to be inspected, degradation mechanisms, aging effects, acceptance criteria, inspection frequency, and periodic reviews to determine program effectiveness. The program will also specifically address inaccessible areas and include inspections of opportunity for possible corrosion under insulation.

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

Conclusion. On the basis of its audit and review of the applicant's External Surfaces Monitoring Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements, as amended, and confirmed that their implementation, through Commitment No. 8, prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.4 Fire Protection Program

Summary of Technical Information in the Application. LRA Section B.3.22 describes the Fire Protection Program as an existing program that is consistent, with exceptions and enhancements, with GALL AMP XI.M26, Fire Protection. The applicant stated that the program manages aging effects for, but is not limited to, fire dampers, fire barrier walls, ceilings and floors, fire-rated penetration seals, diesel driven fire pump fuel oil supply line, fire doors, and the CO_2 fire suppression system.

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

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M26. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M26, with the exception of the "parameters monitored or inspected," and "detection of aging effects" program elements. For these elements, the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

The "parameters monitored or inspected" program element of GALL AMP XI.M26 recommends that visual inspection of approximately 10 percent of each type of penetration seal be performed during walkdowns carried out at least once every RFO. The applicant stated that 35 percent of penetration seals are inspected once each operating cycle with 100 percent visually inspected within 5 years. However, it was not clear to the staff if the 35 percent of penetration seals that are inspected during each operating cycle includes each type of penetration seal. By letter dated September 14, 2009, the staff issued RAI B.3.22-2 requesting that the applicant confirm if the 35 percent sample of visually inspected penetrations seals includes each type of penetration and if not, to justify why this is not an exception to the GALL Report.

In its response dated October 13, 2009, the applicant stated that while the procedural controls on penetration seals do not currently include a specific requirement for an inspection of each type of seal, an enhancement to the program will be made to ensure approximately 10 percent of each type of penetration seal is included in the 35 percent selection of fire barrier seal penetrations that are visually inspected every 18 months. The staff's evaluation of this enhancement is discussed below and the staff concluded that the enhancement is acceptable. The staff's concern described in RAI B.3.22-2 is resolved.

The "parameters monitored or inspected" and "detection of aging effects" program elements of GALL AMP XI.M26 recommend that periodic visual inspection and function tests be performed at least once every six months to examine the signs of degradation of the Halon/CO_2 fire suppression system. The staff noted that the applicant's basis document for this program indicates that performance testing and visual inspection of the CO_2 fire suppression system is done annually. The staff also noted that the applicant did not consider this an exception to the GALL Report. By letter dated September 14, 2009, the staff issued RAI B.3.22-3 requesting that the applicant justify why an exception to the GALL Report is not addressed in the LRA and if an exception is subsequently taken, requested the applicant provide the basis of the exception.

In its response dated October 13, 2009, the applicant agreed to include the annual performance testing and visual inspection of the CO_2 fire suppression system as an exception to GALL AMP XI.M26. The staff's evaluation of this exception is discussed below and the staff concluded that the exception was acceptable. The staff's concern described in RAI B.3.22-3 is resolved.

The "detection of aging effects" program element in GALL AMP XI.M26 recommends that visual inspections of the Halon/CO_2 fire suppression system should detect any sign of degradation, such as corrosion, mechanical damage, or damage to dampers. The “acceptance criteria” program element of GALL AMP XI.M26 recommends that any signs of corrosion and mechanical damage of the Halon/CO_2 fire suppression system discovered during inspections are unacceptable. The staff noted that the applicant’s program basis document and the STP document for the Cardox (CO_2) System Operability Test, only address performance testing and do not include visual inspection. By letter dated September 13, 2009, the staff issued RAI B.3.22-4 requesting that the applicant explain how it proposes to meet the GALL AMP recommendation to detect any sign of corrosion and mechanical damage of the CO_2 fire suppression system.

In its response dated October 13, 2009, the applicant stated that it would revise the LRA to include an enhancement to inspect for corrosion and mechanical damage to system components. The staff’s evaluation of this enhancement is discussed below and the staff concluded that the enhancement is acceptable. The staff’s concern described in RAI B.3.22-4 is resolved.

The “detection of aging effects” program element in GALL AMP XI.M26 recommends that visual inspection by fire protection qualified inspectors of the fire barrier walls, ceilings, and floors, be performed in walkdowns at least once every RFO, and that the visual inspections ensure timely detection of concrete cracking, spalling, and loss of material. The staff noted that the applicant’s program basis document, states that fire barriers are inspected once every 5 years which should be considered an exception to the GALL AMP recommended frequency of once every RFO. The staff also noted that the same basis document references the Structures Monitoring Program and identifies a 10-year inspection cycle. The staff noted that the LRA does not identify this as an exception to GALL AMP XI.M26. By letter dated September 14, 2009, the staff issued RAI B.3.22-5, requesting that the applicant justify why this is not an exception, to provide the basis for the exception, and to explain if the 10-year inspection using the Structures Monitoring Program is in addition to the Fire Protection Program inspection or in lieu of the Fire Protection Program inspection.

In its response dated October 13, 2009, the applicant stated that fire barrier penetration seal inspection surveillance procedure is performed on an 18-month frequency with 100 percent of fire barrier walls, ceilings and floors inspected within 5 years; and the procedure will be enhanced to perform integrity inspections of fire barrier walls, floors, and ceilings to look for concrete cracking, spalling, and loss of material. The applicant also stated that its Maintenance Rule Program for monitoring of structures will not be credited with the Fire Protection Program, and reference to Maintenance Rule Monitoring will be removed from the program basis document.

The staff reviewed the applicant’s response and noted that the applicant is only crediting the Fire Protection Program and has deleted the Maintenance Rule Monitoring program for performing inspections of fire barriers. The staff also noted that the applicant revised Enhancement 1 and Commitment No. 9 to clearly specify that its fire barrier penetration seal inspection surveillance procedure is the document that will be enhanced and will include inspections of fire barrier walls, ceilings, and floors. On the basis that the applicant is deleting the use of the Maintenance Rule Monitoring Program for performing inspections of fire barriers, and that the inspections will include fire barrier walls, floors, and ceilings, the staff finds the applicant’s response acceptable. The staff’s concern described in RAI B.3.22-5 is resolved.

The staff also reviewed the portions of the “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “parameters monitored or inspected” program elements associated with the exceptions and enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these exceptions and enhancements follows.

Exception 1. LRA Section B.3.22 states an exception to the "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements to inspect walls, ceilings, and floors used as fire barriers at an interval of 35 percent once each operating cycle, with 100 percent inspected within a period of 5 years. The applicant indicated that this interval was in accordance with its CLB as issued in License Amendment No. 32. GALL AMP XI.M26, which recommends that these inspections be performed once every RFO.

The staff reviewed License Amendment No. 132 and its associated safety evaluation dated April 24, 1986, and noted that it addresses inspection frequency for penetration seals, and not for fire barrier walls, ceilings, and floors.

By letter dated September 14, 2009, the staff issued RAI B.3.22-1 requesting that the applicant confirm whether the exception should be addressing fire barrier penetration seals and to indicate what happens after the 5-year period.

In its response dated October 13, 2009, the applicant stated that the subsequent 5-year periods continue with this same inspection frequency. The applicant also stated that it has not experienced significant concrete deterioration or degradation; therefore, this inspection interval is adequate to detect any fire barrier degradation prior to loss of intended function.

The staff noted that the applicant considers fire barrier penetration seals synonymous with fire barrier walls, floors, and ceilings and that when the applicant performs inspection of fire barrier walls, floors, and ceilings, it includes the inspection of all fire barrier penetrations located on that wall, floor, or ceiling. The staff noted that, by inspecting 35 percent of the walls, floors, and ceilings, and associated penetration seals once every 5 years, 100 percent of the fire barriers and penetration seals are inspected in a 5-year period. This 100 percent inspection of fire barrier penetration seals in 5 years is more conservative than the GALL Report recommended inspection frequency of 10 percent of each type of penetration seal once every RFO, which would inspect 100 percent of the penetration seals once every 15 years. Based on its review, the staff finds the applicant's response to the RAI acceptable. The staff's concern described in RAI B.3.22-1 is resolved.

Exception 2. In its letter dated October 13, 2009, the applicant responded to RAI B.3.22-3, and identified an exception to the "parameters monitored or inspected," and "detection of aging effects" program elements where the CO_2 fire suppression system for the cable spreading room is inspected annually for signs of degradation (e.g., corrosion, mechanical damage, or damage to dampers). GALL AMP XI.M26 recommends the inspection at least once every six months.

The applicant stated that its operating experience and work request history for the CO_2 fire suppression system has not shown signs of degradation on passive components; however, there have been a few repairs of active equipment. The applicant also stated that performance of the CO_2 system operability test removes this fire suppression system from service. The applicant concluded that performing the visual inspection and the functional test annually is adequate.

The staff reviewed the plant operating experience reports and did not find any age-related degradation in the CO_2 system. On the basis of its review, including plant operating experience, and the fact that the applicant is performing testing and inspection annually, the staff finds that the annual inspection and testing frequency is adequate to ensure the system maintains its function. The staff finds the exception acceptable. The staff's concern described in RAI B.3.22-3 is resolved.

Enhancement 1. LRA Section B.3.22 states an enhancement to the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements to include criteria for visual inspection by fire protection qualified inspectors of the fire barrier walls, ceilings, and floors, in order to detect any signs of degradation, such as cracking, spalling, and loss of material caused by freeze-thaw attack, chemical attack, and reaction with aggregates.

The staff confirmed that the applicant included this enhancement as Commitment No. 9 in LRA Appendix A, Table A-1. This enhancement, when implemented, will make the Fire Protection Program consistent with GALL AMP XI.M26, which recommends that visual inspection of the fire barrier walls, ceilings, and floors examine for signs of degradation such as cracking, spalling, and loss of material caused by freeze-thaw, chemical attack, and reaction with aggregates. Based on its review, the staff finds the enhancement acceptable because it will make the program consistent with the GALL Report.

Enhancement 2. LRA Section B.3.22 states an enhancement to the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements to inspect the entire diesel-driven fire pump fuel supply line for degradation (any component in a state of disrepair).

The staff confirmed that the applicant included this enhancement as Commitment No.10 in LRA Appendix A, Table A-1. This enhancement, when implemented, will make the Fire Protection Program consistent with GALL AMP XI.M26, which recommends that the diesel-driven fire pump is under observation during performance tests, such as flow and discharge tests, sequential starting capability tests, and controller function tests, to detect any degradation of the fuel supply line. Based on its review, the staff finds the enhancement acceptable because it will make the program consistent with the GALL Report.

Enhancement 3. LRA Section B.3.22 states an inspection frequency of 35 percent once each operating cycle with 100 percent visually inspected within a period of 5 years for fire barrier walls, ceilings, and floors which is in accordance with License Amendment Number 132. The "parameters monitored or inspected" program element of GALL AMP XI.M26 recommends that visual inspections of approximately 10 percent of each type of penetration seal be performed during walkdowns carried out at least once every RFO. It was not clear to the staff if the 35 percent of penetration seals that are inspected during each operating cycle includes each type of penetration seal. In its letter dated September 14, 2009, the staff issued RAI B.3.22-2 requesting the applicant to confirm if the 35 percent sample of penetrations seals visually inspected includes each type of penetration seal and if not, to justify why this is not an exception to the GALL Report.

In its response dated October 13, 2009, the applicant included an enhancement to the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements to ensure approximately 10 percent of each type of penetration seal is included in the 35 percent selection of fire barrier penetration seals that are visually inspected every 18 months.

The staff noted that the applicant also included new Commitment No. 43 in its response that states that its fire barrier penetration seal inspection surveillance procedure will be enhanced to ensure that approximately 10 percent of each type of penetration seal is included in the 35 percent selection of fire penetration seals that are visually inspected each operating cycle. The staff notes that this enhancement, when implemented, will make the Fire Protection Program consistent with GALL AMP XI.M26, which recommends that inspection of approximately 10 percent of each type of seal be performed at least once every RFO. Based on its review, the staff finds the enhancement acceptable because it will make the program consistent with the GALL Report. The staff's concern described in RAI B.3.22-2 is resolved.

Enhancement 4. In its letter dated October 13, 2009, the applicant responded to RAI B.3.22-4, and included an enhancement to the "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements to state that its surveillance procedure for the CO_2 Cardox System Operability Annual Test will be revised to include a step to perform an inspection for corrosion and mechanical damage to system components.

The staff noted that the applicant has included new Commitment No. 44 in its response that states that its surveillance procedure for the CO_2 Cardox System Operability Annual Test will be enhanced to include a step to perform an inspection for corrosion and mechanical damage to system components. The staff notes that this enhancement, when implemented, will make the Fire Protection Program consistent with GALL AMP XI.M26, which recommends visual inspections to detect any sign of corrosion and mechanical damage of CO_2 systems be performed. Based on its review, the staff finds the enhancement acceptable because it will make the program consistent with the GALL Report. The staff's concern described in RAI B.3.22-4 is resolved

Based on its audit and review of the applicant's responses to RAIs B.3.22-1, B.3.22-2, B.3.22-3, and B.3.22-4, the staff finds that elements one through six of the applicant's Fire Protection Program, with acceptable exceptions and enhancements, are consistent with the corresponding program elements of GALL AMP XI.M26 and, therefore, acceptable.

Operating Experience. LRA Section B.3.22 summarizes operating experience related to the Fire Protection Program. The applicant stated that the program has been effective in managing the aging effects for the fire protection system and that the program incorporates both industry and plant-specific operating experience to provide added assurance that aging effects are managed such that these components will continue to perform their intended functions throughout the period of extended operation.

The applicant stated that the industry and the staff have revealed a number of instances of silicone foam fire barrier penetration seals having experienced splits, shrinkage, voids, lack of fill, and other failure modes, and problems with fire barriers and water tight fire door seal degradation; furthermore, the applicant routinely evaluates NRC communications on industry fire protection issues for applicability and that its procurement and inspection processes have been enhanced as a result of some of this experience.

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

The staff reviewed the applicant's operating experience discussion that was provided in the applicant's program basis document and a sample of condition reports and confirmed that the applicant had identified age-related degradation and implemented appropriate corrective actions. The staff noted examples of fire door issues, penetration seal cracking, and fire door seal degradation but did not note any age-related degradation in Halon/CO_2 systems.

During its review, the staff identified operating experience which could indicate that the applicant's program may not be effective in adequately managing aging effects during the period of extended operation. The staff determined the need for additional clarification, which resulted in the issuance of an RAI. LRA Section B.3.22 states that "DAEC performs a biennial assessment of the Fire Protection Program. The most recent assessment concluded that, on an overall basis, the Fire Protection Program is satisfactory." Staff review of DAEC operating experience identified a corrective action plan (CAP) 40770 dated March 7, 2006, that was written to address the Fire Protection Self-Assessment of Penetration Seal Program effectiveness. This CAP identified several issues with the penetration seal program and warranted the classification of the penetration seal program as an issue of attention. The penetration seal program inspections are performed under seal inspection procedure STP-NS13F001, which was used by the applicant as the basis to establish consistency with GALL AMP XI.M26. By letter dated September 14, 2009, the staff issued RAI B.3.22-6, requesting that the applicant explain why this plant operating experience was not included in the LRA. The applicant was also requested to identify the corrective actions taken to confirm that the program will provide reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the CLB for the period of extended operation.

In its response dated October 13, 2009, the applicant stated that the issues identified in CAP040770 dealt primarily with configuration control, timeliness in updating configuration control, and in communicating inspection results; therefore, the information was not included in the LRA. The applicant further stated that CAP040770 did not identify any age related degradation or failures of the program to detect and correct aging of fire barriers. The applicant also stated that corrective actions have been completed by establishing a controlled engineering document for penetration seals and by improving surveillance procedures to require prompt communication of inspection results.

The staff reviewed the applicant's response and noted that the issues identified in CAP040770 were not age related but rather on configuration control of penetration seals. The staff also noted that corrective actions have been completed and the controlled engineering document for penetration seals will provide the effective configuration control. On the basis of its review, the staff finds the applicant's response to RAI B.3.22-6 acceptable because the issues were not age related and also because the corrective actions have been completed. The staff's concern described in RAI B.3.22-6 is resolved.

The staff confirmed that the applicant addressed operating experience identified after the issuance of the GALL Report. The staff finds that the applicant's program, with the corrective actions discussed in the LRA, has been effective in identifying, monitoring, and correcting the effects of age related degradation in fire protection systems and can be expected to ensure that the systems and components within the scope of this program will continue to perform their intended functions consistent with the CLB for the period of extended operation.

Based on its audit and review of the application, and review of the applicant's response to RAI B.3.22-6, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

UFSAR Supplement. LRA Section A.18.1.22, provides the UFSAR supplement for the Fire Protection Program.

The staff revised this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.3-2.

The staff also notes that the applicant committed (Commitment Nos. 9, 10, 43, and 44) to enhance the Fire Protection Program prior to entering the period of extended operation. Specifically, the applicant committed to: (1) revise the fire barrier penetration seal inspection surveillance procedure to include the criteria for visual inspections of fire barrier walls, ceilings, and floors to examine for any sign of extended degradation such as cracking, spalling, and loss of material caused by freeze-thaw, chemical attack, and reaction with aggregates by fire protection qualified inspectors; (2) enhance procedures to inspect the entire diesel-driven fire pump fuel supply line for age related degradation; (3) revise the fire barrier penetration seal inspection surveillance to ensure approximately 10 percent of each type of penetration seal is included in the 35 percent selection of penetration seals that are visually inspected at 18-month intervals; and (4) revise the surveillance procedure for the cardox system operability annual test to include a step to perform an inspection for corrosion and mechanical damage to system components.

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

Conclusion. On the basis of its audit and review of the applicant's Fire Protection Program and the applicant's response to the staff's RAI, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff reviewed the exceptions and the applicant's justification and determines 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 Nos. 9, 10, 43, and 44, prior to the period of extended operation, will make the existing AMP consistent with the GALL AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.5 Fire Water System Program

Summary of Technical Information in the Application. LRA Section B.3.23 describes the existing Fire Water System Program as consistent with enhancements with GALL AMP XI.M27, "Fire Water System." The applicant stated that fire water system components are tested in accordance with applicable National Fire Protection Association (NFPA) codes and standards.

The applicant also stated that periodic flow tests are performed to verify design pressure for all fire water sprinkler system piping and components and that the external ring header of the fire suppression water system is periodically flushed and hydraulically tested. The applicant also stated that the fire mains are tested using fire hydrants to identify large blockages or partially closed valves in the fire main and to verify piping integrity and that examinations are periodically performed to detect pipe wall thinning. The applicant also stated that the tests and inspections ensure that corrosion, MIC, or biofouling is managed to ensure that the system function is maintained.

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

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M27. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M27, with the exception of the "detection of aging" program element. For this element the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

The "detection of aging" program element in GALL AMP XI.M27 recommends that fire hydrant hose hydrostatic tests, gasket inspections, and fire hydrant flow tests, be performed annually to ensure that fire hydrants can perform their intended function and provide opportunities for degradation to be detected before a loss of intended function can occur. The staff noted that the applicant's program basis document states that STP-NS13E006, Fire Hose Hydrostatic Pressure Testing procedure provides guidance to perform fire hydrant hose hydrostatic tests and gasket inspections on an annual basis. The staff noted that Section 4.1 of the procedure states that the drywell access cabinet, fire brigade assembly area, and B5b hose hydrostatic pressure tests are performed every 3 years which is not consistent with the GALL Report which recommends that hydrostatic tests of fire hoses be conducted annually. By letter dated September 14, 2009, the staff issued RAI B.3.23-1, requesting the applicant justify why this is not identified as an exception to GALL AMP XI.M27 in the LRA and, if it is an exception, to provide the basis for the 3-year frequency.

By letter dated October 13, 2009, the applicant stated that fire hoses are considered consumables that are replaced based on performance or condition monitoring that identifies when the hoses reach the end of their qualified life and that they may be excluded from AMR under 10 CFR 54.21(a)(1)(ii). The applicant also stated that the standard that is used to test the performance of the fire hoses is provided by the NFPA. The applicant identified that the allowance for this AMR exclusion is provided in SRP-LR Table 2.1-3. The applicant stated that the program basis document should not have referenced STP-NS13E006.

Based on its review of the applicant's response and also SRP-LR Table 2.1-3, the staff finds the applicant's response to the RAI acceptable because fire hoses are considered consumables that are replaced based on performance or condition monitoring, and the applicant performs condition monitoring at periodic intervals. The staff's concern described in RAI B.3.23-1 is resolved.

The staff also reviewed portions of the "detection of aging effects" program element associated with the enhancements to determine whether the program will be adequate to manage the aging efects for which it is credited. The staff's evaluation of this enhancement follows.

Enhancement 1. LRA Section B.3.23 states an enhancement to the "detection of aging effects" program element to revise the program to assure that volumetric inspections for pipe wall thinning of fire protection piping are performed before the end of the current operating term and at plant-specific intervals thereafter during the period of extended operation.

GALL AMP XI.M27 recommends that wall thickness evaluations of fire protection piping be performed on system components using non-intrusive techniques (e.g., volumetric testing) before the end of the current operating term and at plant-specific intervals thereafter during the period of extended operation. The staff confirmed that the applicant has included Commitment No. 11 in LRA Table A-1 to establish maintenance activities to perform volumetric examinations for pipe wall thinning of fire protection piping periodically during the period of extended operation. On the basis that the enhancement, when implemented, will make the program consistent with the GALL Report, the staff finds the enhancement acceptable.

Enhancement 2. LRA Section B.3.23 states an enhancement to the "detection of aging effects" program element to include NFPA Standard 25 criterion that "where sprinklers have been in place for 50 years, they shall be replaced or representative samples from one or more sample areas shall be submitted to a recognized testing laboratory for field service testing." This sampling is performed every 10 years after the initial field service testing to ensure that signs of degradation, such as corrosion, are detected in a timely manner.

GALL AMP XI.M27 recommends that sprinkler heads are inspected before the end of the 50-year sprinkler head service life and at 10-year intervals thereafter during the extended period of operation. The staff confirmed that the applicant has included Commitment No. 12 in LRA Table A-1 to enhance procedures to include the NFPA criterion for sprinklers regarding replacing or testing. On the basis that the enhancement, when implemented, will make the program consistent with the GALL Report, the staff finds the enhancement acceptable.

Enhancement 3. LRA Section B.3.23 states an enhancement to the "detection of aging effects" program element to perform visual inspections of yard hydrants annually, in accordance with NFPA Standard 25, to detect signs of corrosion.

GALL AMP XI.27 recommends that visual inspections of yard fire hydrants be performed annually in accordance with NFPA Standard 25 to ensure timely detection of signs of degradation, such as corrosion. The staff confirmed that the applicant has included Commitment No. 13 in LRA Table A-1 to enhance procedures to perform visual inspections of fire hydrants annually. On the basis that the enhancement, when implemented, will make the program consistent with the GALL Report, the staff finds the enhancement acceptable.

Based on its audit and review of the applicant's responses to RAIs, the staff finds that elements one through six of the applicant's Fire Water System Program, with acceptable enhancements, are consistent with the corresponding program elements of GALL AMP XI.M27 and, therefore, acceptable.

Operating Experience. LRA Section B.3.23 summarizes operating experience related to the Fire Water System Program. The applicant stated that the program has been effective in managing the aging effects for the fire water system and that it incorporates both industry and plant-specific operating experience that provide added assurance that aging effects are managed such that the fire water system components will continue to perform their intended functions throughout the period of extended operation. The applicant also stated that recent testing of the system has not identified any aging effects of the fire water system. The applicant also stated that they routinely evaluate NRC communications on industry fire water system issues for applicability and that these have not impacted the plant fire protection program, procurement, or installations, but the applicant has revised the procurement and inspection process as a result of some of these NRC communications.

The staff also reviewed the applicant’s operating experience discussion that was provided in the applicant’s license renewal basis document for the Fire Protection Program. The staff reviewed a sample of condition reports and confirmed that the applicant had identified age related degradation and implemented appropriate corrective actions. The staff found examples of fire protection piping UT results and associated correction action program documents, and determined that the applicant had taken appropriate corrective actions.

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

During its review, the staff found no operating experience to indicate that the applicant’s program would not be effective in adequately managing aging effects during the period of extended operation. In addition, the staff confirmed that the applicant addressed operating experience identified after the issuance of the GALL Report.

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

<u>UFSAR Supplement</u>. LRA Section A.18.1.23 provides the UFSAR supplement for the Fire Water System Program. The staff reviewed this UFSAR supplement summary description for this type of program as described in SRP-LR Table 3.3-2.

The staff also notes that the applicant committed (Commitment Nos. 11, 12, and 13) to enhance the Fire Water System Program prior to entering the period of extended operation. Specifically, the applicant committed to: (1) establish maintenance activities to perform volumetric examinations for pipe wall thinning of fire protection piping periodically during the period of extended operation; (2) enhance procedures to include NFPA 25 criteria for sprinklers regarding replacing or testing; and (3) enhance procedures to perform visual inspection of fire hydrants annually.

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

<u>Conclusion</u>. On the basis of its audit and review of the applicant’s Fire Water System Program, and the applicant’s response to the staff’s RAI, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation through Commitment Nos.11, 12, and 13 prior to the period of extended operation will 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, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement, as amended, for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.6 Fuel Oil Chemistry Program

Summary of Technical Information in the Application. LRA Section B.3.25 describes the existing Fuel Oil Chemistry Program as consistent, with exceptions and enhancements, with GALL AMP XI.M30. The applicant stated that the program manages the aging effects of loss of material due to general, pitting, and crevice corrosion and MIC on internal surfaces of the diesel fuel oil system piping, piping components, pumps, and tanks by minimizing the potential for a corrosive environment, and by verifying that the actions taken to mitigate corrosion are effective. The applicant also stated that the program includes testing to detect unacceptable levels of water, sediment and particulate contamination; periodic draining, cleaning and inspection of fuel oil tanks; and periodic ultrasonic inspections of selected tank bottom and piping locations.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated. The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M30. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M30, with the exception of the "preventive actions," "parameters monitored or inspected," and "detection of aging effects" program elements. For these elements, the staff determined the need for additional clarification, which resulted in the issuance of RAIs.

The "preventive actions" program element of GALL AMP XI.M30 recommends the use of biocides. During its audit, the staff found that the applicant's Fuel Oil Chemistry Program does not use fuel additives of biocides to minimize biological activity, stabilizers to prevent biological breakdown of the diesel fuel, and corrosion inhibitors to mitigate corrosion. Additionally, GALL AMP XI.M30 recommends monitoring for microbiological organisms under the "parameters monitored or inspected" program element description; however, during its audit, the staff found that it is not stated in the LRA if and how biological activity is monitored. By letter dated September 14, 2009, the staff issued RAI B.3.25-2 requesting that the applicant identify how the presence of microbiological organisms is monitored in fuel tanks and what corrective action will be taken if microbiological organisms are determined to be present in diesel fuel oil.

In its response dated October 13, 2009, the applicant stated that microbiological organisms are identified as part of the monthly particulate (water/sediment) testing of the standby diesel fuel oil day tanks and the fuel oil storage tanks, and that one of the enhancements identified for the Fuel Oil Monitoring Program is to require particulate testing of fuel oil samples from the diesel fire pump day tank. The applicant also stated that if microbiological organisms are identified as part of the particulate analysis, the issue would be entered into the corrective action program and actions would be taken as identified during the corrective action evaluation. The applicant further stated that the technical specification STPs for fuel oil prescribe that if any values are outside of procedural limits, immediate actions are initiated to restore parameters within limits, possibly inclusive of cleaning the fuel oil by recirculating the oil through a cleanup system.

The staff finds the applicant's response acceptable, because microbiological activity would be detected during monthly testing for particulate, and the corrective action program will provide appropriate actions as a result of elevated particulate content. The staff's concern described in RAI B.3.25-2 is resolved.

The "detection of aging effects" program element of GALL AMP XI.M30 recommends that internal surfaces of tanks that are drained for cleaning are visually inspected to detect potential degradation and an ultrasonic thickness measurement of the tank bottom surface be conducted to ensure that significant degradation does not occur. During its audit, the staff found that the applicant's Fuel Oil Chemistry Program states that there are no equipment specific procedures required to validate the quality of the fuel oil in the diesel driven air start air compressor fuel oil tanks. In addition, the applicant stated that these tanks are not subjected to periodic cleaning and visual or UT inspection, because the tanks are small, have high fuel turnover, and general inspections indicate no degradation, and as such, this is not considered an exception to the GALL. By letter dated September 14, 2009, the staff issued RAI B.3.25-3 requesting that the applicant provide further justification for not performing any preventive/mitigative activities and interior visual or one-time UT examinations to confirm that degradation has not occurred in the diesel driven air start air compressor fuel oil tanks.

In its response dated October 13, 2009, the applicant stated that LRA Section B.3.25.4 lists the program enhancements, one of which is to assure that the frequencies for the periodic draining or cleaning of the diesel fuel oil day tanks, diesel fire pump day tanks, and diesel driven air start air compressor fuel oil tanks are on a schedule of every 10 years. The applicant also stated that this enhancement is LRA Commitment No. 16. The applicant further stated in its response to RAI B.3.25-4, that its fourth enhancement for this program and Commitment No. 16 had been amended to include periodic draining, cleaning, and visual inspection of the diesel driven air start air compressor fuel oil tanks.

The staff finds the applicant's response unacceptable because the applicant did not provide sufficient justification for not conducting UT thickness measurements on the diesel driven air start air compressor fuel oil tanks. Despite the tanks being small and having high fuel turnover, sediments, water can collect at the bottom of the tank and lead to corrosion. Additionally, the applicant stated that a general inspection indicated no degradation; however, no thickness data was provided to demonstrate that corrosion that could challenge the component's function does not occur. By letter dated February 22, 2010, the staff issued RAI B.3.25-X requesting that the applicant provide sufficient justification for not performing a UT examination, or revise the enhancement so that the activities are consistent with the recommendations of GALL AMP XI.M30 for the diesel driven air start air compressor fuel oil tanks.

In its response dated March 9, 2010, the applicant stated that the diesel driven air start air compressor fuel oil tanks are 3-3/4 gallon tanks constructed of thin gage sheet metal, painted on the outside and the entire tank can be visually inspected from the outside as well as the inside. The applicant also stated that a UT was not meaningful because of the thickness of the metal. The applicant further stated that the LRA is being revised to incorporate an additional exception to the GALL Report AMP to reflect that a 10-year visual inspection of the outside coatings and accessible inside surfaces of these tanks will implemented.

The staff finds the applicant's response acceptable because a UT would not be meaningful for the thin material of the diesel driven air start air compressor fuel oil tanks and a 10-year visual inspection of the outside coatings and accessible inside surfaces of these tanks will be sufficient to detect aging effects. The staff's concern described in RAI B.3.25-X is resolved.

The "preventive actions" program element of GALL AMP XI.M30 recommends that periodic cleaning of a tank allows removal of sediment, and periodic draining of water collected at the bottom of a tank minimizes the amount of water and the length of contact time. Additionally, the "detection of aging effects" program element of GALL AMP XI.M30 recommends visual inspection of tanks that are drained and cleaned to detect potential degradation. During its audit, the staff found that Enhancement 4 of the applicant's Fuel Oil Chemistry Program states the program will be enhanced by adding periodic draining or cleaning of the diesel fuel oil day tanks, the diesel fire pump day tank, and diesel driven air start air compressor fuel oil tanks on a schedule of every 10 years. By letter dated September 14, 2009, the staff issued RAI B.3.25-4 requesting that the applicant provide justification for not performing both draining and cleaning of these tanks, and whether the diesel fuel oil day tanks, the diesel fire pump day tank, and diesel driven air start air compressor fuel oil tanks will be subjected to visual inspection after they are drained and cleaned on a schedule of every 10 years.

In its response dated October 13, 2009, the applicant stated that Enhancement 4 has been revised to read, "Enhance the Program to assure that the frequencies for the periodic draining, cleaning and visual inspection of the diesel fuel oil day tanks, the diesel fire pump day tank, and diesel driven air start air compressor fuel oil tanks are on a schedule of every 10 years." The applicant also revised Commitment No. 16 to implement draining, cleaning and visual inspection of the diesel fuel oil day tanks, the diesel fire pump day tank, and diesel driven air start air compressor fuel oil tanks on a schedule of every 10 years, prior to the period of extended operation.

The staff finds the applicant's response acceptable, because periodic draining, cleaning, and visual inspections of all diesel fuel oil tanks will be performed on a periodic basis in accordance with the recommendations of GALL AMP XI.M30.

The staff also reviewed the portions of the "scope of the program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements associated with exceptions and enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these exceptions and enhancements follows.

Exception 1. LRA Section B.3.25.3 states an exception to the "scope of the program," "parameters monitored or inspected," and "acceptance criteria" program elements. The staff reviewed this exception to the GALL Report and noted that the applicant took the exception because it uses the non-modified ASTM D2276, "Standard Test Method for Particulate Contaminant in Aviation Fuel by Line Sampling" which uses a filter pore size of 0.8 μm, versus the 3.0 μm specified by the modified ASTM D2276, Method A. However, the staff noted that the referenced GALL Report recommends using the modified ASTM D2276, Method A, for determination of particulates. The applicant stated that using the smaller pore size is more conservative when analyzing for particulate than that recommended in the GALL Report. The staff finds the program exception acceptable because the method to detect fuel oil particulate content is more conservative than that of the method recommended in GALL AMP XI.M30.

Exception 2. LRA Section B.3.25.3 states an exception to the "preventive actions" program element. The staff reviewed this exception to the GALL Report and noted that the applicant took the exception because it does not use fuel additives or biocides to minimize biological activity, stabilizers to prevent biological breakdown of the diesel fuel, or corrosion inhibitors to mitigate corrosion. However, the staff noted that the referenced GALL Report recommends that the quality of fuel oil is maintained by additions of biocides to minimize biological activity, stabilizers to prevent biological breakdown of the diesel fuel, and corrosion inhibitors to mitigate corrosion. The applicant stated that monthly testing for and removal of water and the purchase of quality fuel oil negate the need for additives. The applicant also stated that plant-specific operating experience shows this to be acceptable. The staff noted that the applicant's program controls water, particulate, and sediment to acceptable limits, thereby minimizing the potential for MIC and corrosion. The staff also noted that, during draining, cleaning and inspection of the main diesel tank, no corrosion was found. The staff finds the program exception acceptable because the contaminants that cause MIC and corrosion are minimized and operating experience indicates no loss of material.

Exception 2. LRA Section B.3.25.3 states an exception to the "detection of aging effects" program element. The staff reviewed this exception to the GALL Report and noted that the applicant took exception to performing an ultrasonic thickness measurement of the diesel driven air start air compressor fuel oil tanks. The staff's evaluation and acceptance of this exception is documented above for RAI B.3.25-X.

Enhancement 1. LRA Section B.3.25.4 states an enhancement to the "parameters monitored or inspected" program element. The staff reviewed this enhancement against the corresponding program element in GALL AMP XI.M30. The applicant stated that this enhancement expands on the existing program element to require particulate testing of fuel oil samples from the diesel fire pump day tank. On the basis of its review, the staff finds this enhancement acceptable because it will make the program element consistent with the recommendations in GALL AMP XI.M30.

Enhancement 2. LRA Section B.3.25.4 states an enhancement to the "parameters monitored or inspected" program element. The staff reviewed this enhancement against the corresponding program element in GALL AMP XI.M30. The applicant stated that this enhancement expands on the existing program element by adding a requirement to sample and test new fuel oil delivered to the diesel fire pump day tank. On the basis of its review, the staff finds this enhancement acceptable because it will make the program element consistent with the recommendations in GALL AMP XI.M30.

Enhancement 3. LRA Section B.3.25.4 states an enhancement to the "preventive actions" program element. The staff reviewed this enhancement against the corresponding program element in GALL AMP XI.M30. The applicant stated that this enhancement expands on the existing program element by adding periodic draining or cleaning of the diesel fuel oil day tanks, the diesel fire pump day tank, and diesel driven air start air compressor fuel oil tanks on a schedule of every 10 years. However, the staff noted that the GALL AMP XI.M30 "preventive actions" program element states that periodic cleaning of a tank allows removal of sediment and periodic draining of water collected at the bottom of a tank minimizes the amount of water and the length of contact time. The staff also noted that the GALL AMP XI.M30 "detection of aging effects" program element recommends visual inspection of tanks that are drained and cleaned to detect potential degradation.

By letter dated September 14, 2009, the staff issued RAI B.3.25-4 requesting the applicant to provide justification for not performing both draining and cleaning of these tanks, and whether diesel fuel oil day tanks, the diesel fire pump day tank, and diesel driven air start air compressor fuel oil tanks will be subjected to visual inspection after they are drained and cleaned on a schedule of every 10 years. As discussed above, in its response dated October 13, 2009, the applicant revised the enhancement to include draining, cleaning, and visual inspection of the tanks. The applicant also revised Commitment No. 16 to implement draining, cleaning, and visual inspection of the tanks.

The staff finds the applicant's response to RAI B.3.25-4 acceptable, because periodic draining, cleaning, and visual inspections of all diesel fuel oil tanks will be performed on a periodic basis in accordance with the recommendations of GALL AMP XI.M30. On the basis of its review, the staff finds this enhancement acceptable because it will make the program element consistent with the recommendations in GALL AMP XI.M30

Enhancement 4. LRA Section B.3.25.4 states an enhancement to the "parameters monitored or inspected" program element. The staff reviewed this enhancement against the corresponding program element in GALL AMP XI.M30. The applicant stated that this enhancement expands on the existing program element by creating a procedure for testing the bottom thickness of the diesel fuel oil day tanks on a schedule of every 10 years. On the basis of its review, the staff finds this enhancement acceptable because it will make the program element consistent with the recommendations in GALL AMP XI.M30 by providing verification that corrosion does not occur.

Enhancement 5. LRA Section B.3.25.4 states an enhancement to the "parameters monitored or inspected" program element. The staff reviewed this enhancement against the corresponding program element in GALL AMP XI.M30. The applicant stated that this enhancement expands on the existing program element to create procedures for bottom thickness testing of the standby diesel generator fuel oil day tanks and the diesel fire pump fuel oil day tank every 10 years. On the basis of its review, the staff finds this enhancement acceptable because it will make the program element consistent with the recommendations in GALL AMP XI.M30 by providing reasonable assurance that loss of material is not progressing through the period of extended operation.

Based on its audit and review of the applicant's response to RAIs B.3.25-2, B.3.25-3 and B.3.25-4 and B.3.25-X, the staff finds that elements one through six of the applicant's Fuel Oil Chemistry Program, with acceptable exceptions and enhancements, are consistent with the corresponding program elements of GALL AMP XI.M30 and are, therefore, acceptable.

Operating Experience. LRA Section B.3.25 summarizes operating experience related to the Fuel Oil Chemistry Program. The applicant stated that the program has been effective in managing the aging effects of loss of material due to corrosion including microbiological organisms. The applicant also cited the results of an inspection of the main diesel fuel oil storage tank performed in April 2001 where it was found to be in excellent condition, including an ultrasonic thickness survey that found no material loss from the preceding 27 years of service. The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program. During its review, the staff identified operating experience which could indicate that the applicant's program may not be effective in adequately managing aging effects during the period of extended operation. The staff determined the need for additional clarification, which resulted in the issuance of RAIs.

In LRA Section B.3.25.5, the applicant stated that it had addressed operating experience related to fuel oil chemistry issues; however, the staff found that the applicant had not addressed that Biodiesel B5 blend: (1) can have a cleaning effect that can increase sediment that could plug filters, (2) could form “dirty water” which leads to algae growth, (3) is biodegradable such that long term storage is not recommended, and (4) can be more susceptible to gel creation. By letter dated September 14, 2009, the staff issued RAI B.3.25-1 requesting that that applicant identify the method(s) being used to assure that biodiesel fuel is not inadvertently being introduced into fuel tanks.

In its response dated October 13, 2009, the applicant stated that biodiesel fuel is not used, and will not be used in the future, because purchase orders for diesel fuel for the standby diesel generators and the plant chemistry procedure for testing diesel fuel oil on delivery verifies that no biodiesel is present in the fuel sample. The applicant also stated that an enhancement will be incorporated into the LRA to assure that the purchase orders and sampling procedures for diesel fuel intended for use in the diesel fire pump fuel oil day tank specify that no biodiesel fuel is to be introduced to this storage tank as well. The applicant further stated that Commitment No. 15 was revised to require that purchase orders and sampling procedures for new fuel oil delivered to the diesel fire pump day fuel oil tank prohibit the delivery and use of biodiesel fuel. Based on its review, the staff finds the applicant’s response to RAI B.3.25-1 acceptable because controls to assure biodiesel fuel will not be introduced in fuel oil systems have been or will be implemented prior to the period of extended operation. The staff’s concern described in RAI B.3.25-1 is resolved.

During its review and audit, the staff noted that the applicant stated in the “operating experience” program element that the main diesel fuel oil storage tank was drained, cleaned, and ultrasonically inspected in April 2001. The staff noted that GALL AMP XI.M30 recommends visual examination after draining and cleaning. It was not clear to the staff whether visual inspection was performed at that time and whether visual inspection will be performed after draining and cleaning in the future. By letter dated September 14, 2009, the staff issued RAI B.3.25-5 requesting that the applicant identify whether visual inspection was performed on the main diesel fuel oil storage tank and whether interior visual inspection will be performed for fuel tanks after draining and cleaning.

In its response dated October 13, 2009, the applicant stated that the work order package indicated that visual inspection of the tank revealed the tank to be in good condition, with no observed degradation, and that visual inspection will be performed after draining and cleaning in the future.

Based on its review, the staff finds the applicant’s response to RAI B.3.25-5 acceptable, because a visual inspection had been and will be performed after draining and cleaning of diesel fuel oil tanks in accordance with the recommendation of GALL AMP XI.M30. The staff’s concern described in RAI B.3.25-5 is resolved.

Based on its audit and review of the application, and review of the applicant’s responses to RAIs B.3.25-1 and B.3.25-5, the staff finds that operating experience related to the applicant’s program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the “operating experience” program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

UFSAR Supplement. LRA Section A.18.1.25 provides the UFSAR supplement for the Fuel Oil Chemistry Program. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type program as described in SRP-LR Table 3.3-2.

The staff also notes that the applicant committed (Commitment Nos. 14, 15, 16, and 17) to enhance the Fuel Oil Chemistry Program prior to the period of extended operation. Specifically, the applicant committed to:

- Revise the program to require particulate testing of fuel oil samples from the diesel fire pump day tank.
- Enhance procedures to require sampling and testing of new fuel oil delivered to the diesel fire pump day tank; and to require that purchase orders and sampling procedures for diesel fuel delivered to and stored in the diesel fire pump day tank prohibit the delivery and use of biodiesel fuel.
- Enhance procedures to perform periodic (10-year) draining, cleaning and visual inspection of the diesel fuel oil day tanks, diesel fire pump day tank, and diesel driven air start air compressor fuel oil tanks.
- Establish procedures to require bottom thickness testing of the standby diesel generator day tanks and diesel fire pump day tank.

The staff determines that the information in the UFSAR Supplement, as amended, is an adequate summary description of the program, as required by 10 CFR 54.21(d).

<u>Conclusion</u>. On the basis of its audit and review of the applicant's Fuel Oil Chemistry 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 the applicant's justifications and determines that the AMP, with the exceptions, is adequate to manage the aging effects for which the LRA credits it. Also, the staff reviewed the enhancements and confirmed that their implementation through Commitment Nos. 14, 15, 16, and 17 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, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.7 Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program

<u>Summary of Technical Information in the Application</u>. LRA Section B.3.29 describes the existing Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program as being consistent, with enhancements, to GALL AMP XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems."

The applicant stated its program includes the following heavy and light load handling systems:

- 1H001 – reactor building crane

- 1H003 – turbine building crane
- 1S081 – refueling platform (includes 1H209 – refuel platform auxiliary hoist)
- 1H005A/B – recirculation pump motor hoist
- 1H011 – refuel floor jib crane
- 1H013 – drywell shield blocks and personnel air lock hoist
- 1H018 – fuel pool demineralizer area hoist
- 1H023 – spent fuel pool gamma scan collimator port hoist
- 1H212 – south torus hatch equipment hoist
- 1H220 – drywell equipment hatch hoist
- torus monorail

The applicant stated that the program addresses the management of material degradation due to general corrosion of the applicable system's supporting steel and the wear on the crane rails through periodic visual inspection in accordance with industry standards. The applicant also stated that the program will record and evaluate the effects of past and future usage on the reactor building crane and turbine building crane.

The applicant further stated that the remaining in-scope load handling systems were not designed for a limited number of lifts above their respective rated capacities. However, the applicant stated that, for these systems, loading is limited within their design specification through administrative procedures. The applicant stated that, through loading control, fatigue damage is not expected for these load-handling systems and the fatigue usage is not recorded.

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

During its audit, the staff interviewed the applicant, and noted that the program is implemented through procedures that are based on NRC approved guidance. Furthermore, inspections are visual in nature, and are conducted on a routine basis for degradation.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M23. As discussed in the Audit Report, the staff confirmed that these elements are consistent with the corresponding elements of GALL AMP XI.M23.

The staff also reviewed the portions of the "parameters monitored or inspected" program element associated with the enhancement to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these enhancements follows.

Enhancement. LRA Section B.3.29 states an enhancement to the "parameters monitored or inspected" program element. The applicant stated that its program will be enhanced: (1) to include corrosion and wear as monitored parameters for the supporting steel and rails of the respective load handling systems and (2) to include procedures for recording usage of the reactor building crane and turbine building crane.

The staff noted that the "parameters monitored or inspected" program element of GALL AMP XI.M23 states that "The program evaluates the effectiveness of the maintenance monitoring program and the effects of past and future usage on the structural reliability of cranes." The staff further noted that GALL AMP XI.M23 recommends that the effects of general corrosion on the crane and trolley structural components and the effects of wear on the rails in the rail system are managed.

During its audit, the staff reviewed the applicant's program basis document and noted that this program visually inspects cranes, hoists, the refueling platform, and the torus monorail for aging effects that could impair the load handling system from performing its intended function and that for these systems, all structural steel members, including those of the bridge, trolley, and monorail, are inspected for general corrosion. The staff also noted that the procedures for tracking and recording the usage of the reactor building and turbine building cranes will be established as an enhancement to its program and that both of these cranes have been designed to allow a limited number of lifts at 125 percent of the rated capacity, and thus the operational usage of these systems needs to be recorded to ensure that the cranes remain within their design basis during the period of extended operation.

Based on its review, the staff finds these enhancements acceptable because the applicant: (1) will monitor for general corrosion and wear on the supporting steel and rails and (2) will track the usage of the reactor building crane and turbine building crane, consistent with the recommendations of GALL AMP XI.M23.

Based on its audit, the staff finds that elements one through six of the applicant's Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program, with an acceptable enhancement, are consistent with the corresponding program elements of GALL AMP XI.M23 and are, therefore, acceptable.

Operating Experience. LRA Section B.3.29 summarizes operating experience related to the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program. The staff also confirmed that the applicant has addressed operating experience that occurred after 1996, as described below:

(1) Inspection of the turbine building crane in 1996 through the Maintenance Rule Monitoring of Structures Program did reveal limited surface corrosion on the walking platform fasteners. However, further examination of the fasteners revealed that the degradation did not pose a threat to the operability of the crane. Followup inspections in 1998 and 2007 indicated no further degradation, and the issue is scheduled to be reexamined during the next regularly scheduled Maintenance Rule inspection.

(2) During RFO 20 in 2007, inspection of the turbine building crane, following an overcapacity lift, identified cracks along the welded interface of the mechanical stops and bridge rails. The crane manufacturer was notified of the defect and the crane manufacturer cleared the crane for further use. Additional inspections during the same outage identified three instances of loose bolting on the south end of the east bridge rail. In all occurrences, the bolting was retightened and torqued to the proper value.

During its audit, the staff interviewed the applicant's technical personnel and confirmed that no adverse effects due to the degradation and loosened bolts described above have resulted in threatening conditions to structural integrity of the turbine building crane. The staff confirmed that the applicant has taken appropriate actions following each of the findings described.

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

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

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

UFSAR Supplement. LRA Section 18.1.29 provides the UFSAR supplement for the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.3-2.

The staff also notes that the applicant committed (Commitment No. 21 and 22) to enhance the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program prior to entering the period of extended operation. Specifically, the applicant committed to enhance its program: (1) to include corrosion and wear as monitored parameters for the supporting steel and rails of the respective load handling systems and (2) to include procedures for recording usage of the reactor building crane and turbine building crane, respectively.

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

Conclusion. On the basis of its audit and review of the applicant's Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation through Commitment No. 21 and No. 22 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, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.8 Lubricating Oil Analysis Program

Summary of Technical Information in the Application. LRA Section B.3.30 describes the existing Lubricating Oil Analysis Program as consistent, with an enhancement, with GALL AMP XI.M39, "Lubricating Oil Analysis." The applicant stated that the program manages the aging effects of loss of material, cracking, or heat transfer degradation in piping, heat exchangers, and other components and equipment that are a part of the supporting lube oil system through the analysis and trending of oil samples. The applicant also stated that the program monitors the contaminants in the lubricating oil, including water and particulates, to ensure they remain within acceptable limits. The applicant further stated the program's sampling and analysis plan also provides an early warning of potential adverse equipment conditions in lubricated oil environments.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine whether they are bounded by the conditions for which the GALL Report was evaluated. The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.M39. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.M39 with the exception of the "parameters monitored or inspected" program element. For this element, the staff determined the need for additional clarification, which resulted in the issuance of an RAI.

GALL AMP XI.M39 recommends conducting a flash point test on oil samples from components that do not have regular oil changes; however, during its audit, the staff found that the applicant's program basis document does not have this requirement. By letter dated September 14, 2009, the staff issued RAI B.3.30-1, requesting that the applicant justify not conducting the recommended test and questioned if there were other tests that could be performed to verify the suitability of the oil for continued use.

In its response dated October 13, 2009, the applicant stated that the flash point testing is being performed in accordance with established plant procedures, as well as all of the recommended testing per GALL AMP XI.M39. The applicant also stated that for clarity, flash point testing was added to the program basis document as a test parameter. The applicant further stated that its program is based on adherence to ASTM D6224-98 "Standard Practice for In-Service Monitoring of Lubricating Oil for Auxiliary Power Plant Equipment," which provides effective monitoring of the mineral oil and phosphate ester fluid lubricating oils in service and, therefore, the program is designed to provide adequate testing for the suitability of oil for continued use. The applicant stated that the tests include particle counts, viscosity, glycol contamination, water contamination, solids, spectrochemical analysis for additives, wear metals, dirt/sand, and where applicable, total acid number and flash point. In a conference call conducted on January 14, 2010, the applicant reiterated that spectrochemical analysis/testing is primarily performed to track metal particles. The applicant, at that time, also stated that the program has provisions to test for bacteria products if there is a susceptibility of microbiological corrosion taking place in a wetted environment.

The staff finds the applicant's response to the RAI acceptable because the information provided indicates that the program is consistent with the "parameters monitored or inspected" program element of GALL AMP XI.M39. The staff's concern described in RAI B.3.30-1 is resolved.

The staff also reviewed the portions of the "parameters monitored or inspected" program element associated with the enhancement to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this enhancement follows.

Enhancement 1. LRA Section B.3.30 states an enhancement to the "parameters monitored or inspected" program element. The applicant stated that the program will be enhanced through the addition of the diesel fire pump to its database for obtaining oil samples and required parameters to be monitored. The staff reviewed this enhancement against the corresponding program element in GALL AMP XI.M39. The staff noted that the applicant's program was appropriately enhanced to include the diesel fire pump. On the basis of its review, the staff finds this enhancement acceptable because, when it is implemented prior to the period of extended operation, it will make the program consistent with the recommendations in GALL AMP XI.M39.

Based on its audit, and review of the applicant's response to RAI B.3.30-1, the staff finds that elements one through six of the applicant's Lubricating Oil Analysis Program, with an acceptable enhancement, are consistent with the corresponding program elements of GALL AMP XI.M39 and, therefore, acceptable.

Operating Experience. LRA Section B.3.30 summarizes operating experience related to the Lubricating Oil Analysis Program. The applicant stated that the program has been effective in managing the aging effects for loss of material. The applicant also stated that the program incorporates both industry and plant-specific operating experience providing assurance that aging effects are managed and systems will perform their intended functions throughout the extended operation. The applicant cited two examples to demonstrate the effectiveness of the plant-specific operating experience in the program, one dealing with oil discoloration and the other with low oil oxidation life in two different components. The applicant stated that in both instances engineering concluded that no operability issues existed, although further debris inspections were conducted in the first case and a work order was written to replace the oil in the second; as well as history verifications and sending samples to external labs for further verifications.

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

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

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

UFSAR Supplement. LRA Section A.18.1.30 provides the UFSAR supplement for the Lubricating Oil Analysis Program. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Tables 3.2-2, 3.3-2, and 3.4-2.

The staff also notes that the applicant committed (Commitment No. 23) to enhance the Lubricating Oil Analysis Program prior to entering the period of extended operation. Specifically, the applicant committed to enhance their program to include the diesel fire pump to the group of equipment crediting this program. The inclusion of this equipment will occur prior to entering the extended operation.

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

Conclusion. On the basis of its audit and review of the applicant's Lubricating Oil Analysis Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancement and confirmed that its implementation through Commitment No. 23 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, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.9 Metal-Enclosed Bus Program

Summary of Technical Information in the Application. LRA Section B.3.31 describes the new Metal-Enclosed Bus Program as consistent, with one exception, to GALL AMP XI.E4 "Metal-Enclosed Bus." The applicant stated that the program manages the aging effects of loosening of bolted connections due to thermal cycling and ohmic heating, reduced IR, and moisture/debris intrusion.

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

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.E4. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding element of GALL AMP XI.E4.

The staff also reviewed the portions of the "detection of aging effects" program element associated with the exception to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this exception follows.

Exception. LRA Section B.3.31 states an exception to the "detection of aging effects" program element. GALL AMP XI.E4 recommends a 5-year frequency for visual inspections when no thermographic inspections are performed. The applicant proposed to perform the visual inspections on a 6-year frequency as part of the major inspection of the associated transformer. The applicant stated that the inspections that have been performed since the bus bar insulation was replaced have not identified any degradation. Therefore, the applicant concluded that performing visual inspections on a 6-year frequency provides reasonable assurance that the metal-enclosed bus (MEB) will be maintained consistent with the CLB through the period of extended operation.

The applicant proposed to perform visual inspection on a 6-year frequency instead of a 5-year frequency as recommended by GALL AMP XI.E4. This is less conservative than a 5-year frequency as recommended by GALL AMP XI.E4. It was not clear to the staff that the applicant's justification of a 6-year visual inspection frequency, which was based on no bus connection failures, was adequately justified while industry operating experience indicates that buses in MEBs may experience loosening of bolted connections resulting from repeated cycling of connected loads. The staff noted that this phenomenon can occur in heavily-loaded circuits (i.e., those exposed to appreciable ohmic heating). NRC IN 2000-14 identifies torque relaxation of splice plate connecting bolts as one potential cause of an MEB fault. In addition the staff noted, Sandia Laboratory Report, SAND-0344 identifies instances of termination loosening at several plants due to thermal cycling. By letter dated November 13, 2009, the staff issued RAI B.3.31-1 requesting that the applicant provide additional technical justification of how an exception to the GALL Report for inspecting the bus bar connections of 6-year will not result in failure to achieve early detection of the loosening of bolted connections resulting from repeated cycling of connected loads

In its response dated December 14, 2009, the applicant stated that it has operating experience with MEB inspections that supports the adequacy of a 6-year inspection frequency. Visual inspections of MEB have been performed on a 6-year frequency since 1990. The initial inspection in 1990 did identify degraded bus insulation, but the degradation was not severe enough to result in failure of the bus. The applicant stated that the MEB insulation and bolting hardware were replaced in 1992 and 1993. Subsequently, visual inspections have been performed in 1996, 2002, and 2009. Furthermore, since the repairs were completed, the periodic inspections have not identified any problems with insulation degradation, signs of thermal damage (indicating loose bolting), or the presence of foreign material. The applicant has not experienced failures of MEB. The applicant also stated that 6-year MEB inspections are performed as part of the 6-year major inspection of the startup transformer and the bus and transformer must be taken out of service to provide access for inspection. Furthermore, taking the startup transformer out of service increases the overall risk to the plant since the startup transformer is one of the two offsite power sources. It is not desirable from the standpoint of nuclear safety to take the startup transformer and MEB out of service more frequently than necessary just to perform an inspection, especially when the inspection history continues to confirm that age-related degradation does not occur. The applicant stated the 6-year inspection frequency for the startup transformer considers industry operating experience to prevent failure of the transformer and GALL AMP XI.E4, "Metal-Enclosed Bus," indicates that a primary aging stressor for MEB is to have heavily loaded connections combined with cyclic loading. As discussed below, the applicant stated that MEB within the scope of license renewal at DAEC is not normally heavily loaded, and the cyclic loading that does occur on the bus is not of large magnitude and does not result in significant rises in bus temperature.

<u>Description of MEB Loads and Worst Case Cycling</u>. The applicant stated that MEB within the scope of license renewal is a 1,200 amp bus with a short section of 3,000 amp bus near the startup transformer. The major loads fed by each in-scope MEB are:

- Control Building Load Center
- Intake Structure Load Center
- Core Spray Pump Motor (700 hp)
- RHR Pump Motor (600 hp)
- RHR Pump Motor (600 hp)
- RHR Service Water Pump Motor (600 hp)
- RHR Service Water Pump Motor (600 hp)
- General Service Water Pump Motor (250 hp)

- CRD Pump Motor (250 hp)

The applicant stated the control building load center and intake structure load center combined form the base load of approximately 100 amps or 8.3 percent of the rated bus ampacity. Furthermore, this represents only 0.7 percent of the rated bus temperature rise. The general service water (GSW) pump motor and the CRD pump motor may be loaded on the bus for extended periods of time (greater than 1 week). Each of these motors draws approximately 33 amps. The maximum normal loading on the bus for an extended period would be approximately 166 amps (100 amps + 66 amps) or 13.8 percent of the rated bus ampacity. The applicant stated this loading represents only 2 percent of the rated bus temperature rise. Therefore, the applicant concluded that bus is not normally heavily loaded. There is no scenario during normal plant operations that would have all the other five motors operating at the same time. The worst case loading would have the two RHR and two RHRSW pump motors operating at the same time as a GSW pump and a CRD pump during an outage. Each RHR and RHRSW pump motor draws approximately 80 amps. This would increase the current flowing through the bus from 166 amps to 482 amps, which is approximately 40 percent of the rated bus ampacity. Therefore, even under these conditions, the applicant stated that the bus is not heavily loaded. This loading represents the worst case from the standpoint of normal operating load cycling. Operating the six motors in this situation would increase bus temperature from 0.7 percent of the rated bus temperature rise due to the base load to approximately 16 percent of the rated bus temperature rise. This is not considered a major transient with respect to bus temperature cycling.

Typical MEB Load Cycling. The applicant further stated that typical operating histories for the motors which are powered from the in-scope MEB and their contributions to bus temperature cycling, are summarized below.

The GSW pump motor and the CRD pump motor are cycled infrequently. The CRD pump motor was cycled 17 times in the last year (cycled defined as either turned on or turned off). The GSW pump motor was cycled 28 times in the last year. These two motors combined represent 5.5 percent of the rated bus ampacity. Cycling these motors on and off the bus does not significantly stress the bolting since these motors combined only represent an incremental bus temperature rise of 0.3 percent. The applicant also stated that cycling the two RHR and two RHRSW pump motors on the bus is the most significant cycling performed. This scenario only happens during testing or an outage and would only occur a small number of times per year based on current operating history. These four motors combined represent 27 percent of the rated bus ampacity. Cycling these motors on and off the bus does not significantly stress the bolting since these motors combined only represent an incremental bus temperature rise of 7.1 percent.

The applicant stated that surveillance testing cycled the core spray pump motor on and off the bus 14 times in the last year. This motor draws approximately 95 amps which represents 8 percent of the rated bus ampacity. Cycling this motor on and off the bus does not significantly stress the bolting since this motor only represents an incremental bus temperature rise of 0.6 percent. Surveillance testing cycled the RHR and RHRSW motors on and off the bus less than 100 times over the last year. Less than 50 of these cycles would include more than two motors. The motors are sequenced on during these tests, which limits to some extent the thermal transient on the bus. The RHR system surveillance test only operates one RHR pump at a time, but both RHRSW pumps may be operating. If it is assumed that the three motors are cycled on at one time, the three motors represent 20 percent of the rated bus ampacity. Cycling these motors on and off the bus does not significantly stress the bolting since these motors combined only represent an incremental bus temperature rise of 4 percent.

Based on its review, the staff finds the applicant's response to RAI B.3.31-1 and this exception acceptable because of the following reasons:

(1) The worst case load cycling would increase the bus temperature from 0.7 percent of the rated bus temperature rise due to the base load to 16 percent of the rated bus temperature rise. Since the metal-enclosed buses within the scope of license renewal are not heavily loaded, and the cyclic loading does not cause significant thermal cycles, the bolting is not stressed significantly.

(2) The three periodic inspections that have been performed on the metal-enclosed bus since they were reinsulated in 1992 and 1993 have not identified any degradation of the insulation.

(3) In order to perform visual inspection of bolted connection in the MEBs, the startup transformer must be taken out of service. Taking the startup transformer out of service increases the overall risk to the plant since the startup transformer is one of the two offsite power sources. It is not desirable from the standpoint of nuclear safety to take the startup transformer and MEB out of service more frequently than necessary just to perform an inspection, especially when the inspection history continues to confirm that age-related degradation does not occur.

(4) GALL AMP XI.E4 recommends inspection of the internal portions of MEBs every 10 years and bolted connections, using thermography or resistance measurement, every 10 years. The 6-year inspection of MEBs is more conservative than the overall 10 years frequency as recommended in the GALL Report.

The staff's concern described in RAI B.3.31-1 is resolved.

Based on its audit, and review of the applicant's response to RAI B.3.31-1, the staff finds that elements one through six of the applicant's Metal-Enclosed Bus Program, with an acceptable exception, are consistent with the corresponding program elements of GALL AMP XI.E4 and are, therefore, acceptable.

<u>Operating Experience</u>. LRA Section B.3.31 summarizes operating experience related to the Metal-Enclosed Bus Program. The applicant stated its program uses existing maintenance activities and will take credit for having been effective in managing the aging effects of loosening of bolted connections due to thermal cycling and ohmic heating, reduced IR, and moisture/debris intrusion. The applicant also stated that the program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended functions. The applicant stated it has not experienced failures of non-segregated electrical bus. However, the DAEC has experienced significant degradation of the bus insulation. The degradation of the bus insulation was identified as a result of periodic inspection performed in 1990. The degradation of the bus insulation did not result in failure of the bus. The bus insulation was replaced in 1992 and 1993. The applicant further stated that inspections performed during 1996 and 2002 did not identify any problems with insulation degradation, signs of thermal damage (indicating loose bolting) or foreign material.

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

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

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

UFSAR Supplement. LRA Section 18.1.31 provides the UFSAR supplement for the Metal-Enclosed Bus Program. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.6-2.

The staff also notes that the applicant committed (Commitment No. 24) to implement the new Metal-Enclosed Bus Program prior to entering the period of extended operation for managing aging of applicable components.

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

Conclusion. On the basis of its audit and review of the applicant's Metal-Enclosed Bus 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 the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.10 Reactor Vessel Surveillance Program

Summary of Technical Information in the Application. LRA Section B.3.35 covers the Reactor Vessel Surveillance Program. DAEC uses the Integrated Surveillance Program (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 BWRVIP-78, "BWR Integrated Surveillance Program Plan," and BWRVIP-86-A, "BWR Vessel and Internals Project, BWR Integrated Surveillance Program Implementation," which were approved by the staff as part of Technical Specification Amendment 262.

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.

For the current license period, 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 AMP XI.M31 for the period of the current DAEC license. The staff concluded that the BWRVIP ISP in the BWRVIP-78 and BWRVIP-86-A reports is acceptable for BWR licensee implementation provided that all participating applicants use one or more compatible neutron fluence methodologies acceptable to the staff for determining surveillance capsule and RPV neutron fluences. The staff's acceptance of the BWRVIP ISP for the current term at DAEC is documented in Technical Specification Amendment 262 which was issued on November 27, 2006.

For the period of extended operation, the applicant has stated that the enhanced program will be consistent with GALL AMP XI.M31. The BWRVIP-116 report, which the applicant will implement (Commitment No. 27), 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. In addition, the applicant proposed two enhancements to the GALL AMP XI.M31. The first enhancement will enable the applicant to evaluate the effect of the emerging ISP data on DAEC's RPV beltline materials and plant operating limits (Commitment No. 26).

The second enhancement confirms that future surveillance capsules that will be withdrawn will be placed in storage after being tested. The staff determined that by implementing these enhancements the applicant has demonstrated that the effects of aging due to loss of fracture toughness of the RPV beltline region will be adequately managed during the period of extended operation.

The staff also reviewed the UFSAR supplement in Appendix A, Section 18.1.35, and by letter dated September 24, 2009, issued RAI B.3.35-1, requesting that the applicant include the following statements in the UFSAR and LRA commitment table: (1) the applicant will obtain staff approval of any change in the withdrawal schedules of the RPV surveillance capsules, and (2) if a standby capsule is removed from the RPV 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, if necessary.

By letter dated October 23, 2009, the applicant revised Commitment No. 28 to include the aforementioned items. The staff accepts this response as the applicant complied with the staff's request.

On the basis of its review, the staff finds that, with enhancements to the Reactor Vessel Surveillance Program, the staff finds 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, as required by 10 CFR 54.21(a)(3). However, the staff will require the following license condition for DAEC:

> Any changes to the BWRVIP ISP capsule withdrawal schedule must be submitted for staff review and approval. Any changes to the BWRVIP ISP capsule withdrawal schedule which affects the time of withdrawal of any surveillance capsules must be incorporated into the licensing basis. If any

surveillance capsules are removed without the intent to test them, these capsules must be stored in [a] manner which maintains them in a condition which would support re-insertion into the RPV, if necessary.

UFSAR Supplement. UFSAR Section 18.1.35 addresses the applicant's compliance with the requirements of 10 CFR Part 50, Appendix H, and GALL AMP XI.M31. Compliance with these requirements demonstrates the applicant's capability in effectively monitoring neutron irradiation embrittlement of the RPV beltline materials at DAEC. The staff reviewed this section and determined that the information in the UFSAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's 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 concluded 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, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.11 Structures Monitoring Program

Summary of Technical Information in the Application. LRA Section B.3.37 describes the existing Structures Monitoring Program as being consistent, with enhancements, with GALL AMP XI.S6, "Structures Monitoring Program." The LRA also states that the Structures Monitoring Program incorporates the required elements of GALL AMPs XI.S5, "Masonry Wall Program," and GALL AMP XI.S7, "Inspection of Water Control Structures Associated with Nuclear Power Plants." The program is based on guidance provided in RG 1.160, Revision 2, NUMARC 93-01, Revision 2, and RG 1.127. The applicant stated that the program includes periodic visual inspections of structures and structural components for detection of aging effects at a frequency determined by the characteristics of the environment in which the structure is found. Individuals conducting the inspections and reviewing results are qualified in accordance with requirements provided in American Concrete Institute (ACI) 349.3R-96.

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

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMPs XI.S5, XI.S6, and XI.S7. As discussed in the Audit Report, the staff confirmed that each element of the applicant's program is consistent with the corresponding elements of GALL AMPs XI.S5, XI.S6, and XI.S7.

The staff also reviewed the portions of the "scope of the program," "parameters monitored or inspected," and "detection of aging effects" program elements associated with the enhancements to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these enhancements follows.

Enhancement 1. LRA Section B.3.37 states an enhancement to "scope of the program" program element. The applicant stated that this enhancement is needed to include inspection of structures and structural components that are not currently included in the Maintenance Rule Program. During its audit, the staff reviewed the applicant's program basis documents and confirmed that the structures inspected under the Structures Monitoring Program aligned with the in-scope structures listed in LRA Section 2.4. The applicant's program basis documents also stated that the masonry walls identified as having an intended function for license renewal and the intake structure will be inspected under the Structures Monitoring Program, in accordance with GALL AMPs XI.S5 and XI.S7.

Based on its review, the staff finds this enhancement acceptable because when the enhancement is implemented, the Structures Monitoring Program will be consistent with GALL AMPs XI.S5, XI.S6, and XI.S7, and provide assurance that the effects of aging will be adequately managed.

Enhancement 2. LRA Section B.3.37 states an enhancement to "parameters monitored or inspected" program element. The applicant stated that this enhancement is needed to include periodic sampling of groundwater for chloride concentration, sulfate concentration, and pH on a 10-year basis. The applicant further stated this enhancement will provide an adequate determination of the aggressiveness of the site groundwater, as suggested in the GALL Report.

The staff reviewed the enhancement and determines that the sampling will properly classify the groundwater; however, the staff noted that the 10-year inspection interval is inadequate and is not clear how the proposed sampling will account for seasonal variations, as discussed in the GALL Report. The staff was also unclear as to how the groundwater sample locations will provide an adequate representation of the groundwater in contact with concrete foundations. By letter dated September 14, 2009, the staff issued RAI B.3.37-2, requesting the applicant justify the adequacy of the groundwater sampling.

In its response dated October 13, 2009, the applicant provided groundwater sampling results from September 2007. The staff noted the samples were taken from six shallow wells located around the site. The staff further noted that all the results (as shown below) fall within the GALL Report limits (pH greater than 5.5, chlorides less than 500 parts per million (ppm), and sulfates less than 1500 ppm). The applicant explained that groundwater flows towards the river in a generally southeasterly direction across the site; therefore, wells to the northwest of the plant, specifically D113 would be representative of groundwater affecting the power block. The applicant further stated that significant changes in river or groundwater chemistry that has been stable for many years are unlikely to occur. The applicant stated that the results do not indicate an aggressive environment that might warrant more frequent monitoring.

Groundwater Monitoring Results from September 2007

Sample Description	**Shallow Wells**					
	D111	D112	D113	D114	D115	D116
pH	6.60	6.87	7.06	6.87	7.20	6.79
Chloride (ppm)	77	62	124	48	14	110
Sulfate (ppm)	349	470	112	270	14	92

The staff reviewed the applicant's response and determines that the location of the wells provides an adequate representation of groundwater in contact with plant foundations. The staff also determines that the groundwater is well within the GALL Report limits for non-aggressive groundwater. However, the staff does not agree that historical values are an indicator of future conditions or that the groundwater chemistry can be properly monitored with a 10-year sampling interval. Therefore, the staff finds the applicant's response to RAI B.3.37-2 unacceptable and by letter dated January 6, 2010; the staff issued follow-up RAI B.3.37-2, requesting the applicant explain why a 10-year interval is adequate without discussing historical measurements.

In its response dated February 2, 2010, the applicant committed to perform sampling of groundwater on a 5-year periodicity. This resolves the staff's concern because it aligns the groundwater monitoring frequency with the recommendations of industry standards and guidance. The staff's concern in follow-up RAI B.3.37-2 is resolved.

Based on its review, the staff finds this enhancement acceptable because when the enhancement is implemented, the applicant's Structures Monitoring Program will be consistent with the recommendations of GALL AMP XI.S5 and will provide assurance that the effects of aging will be adequately managed.

Enhancement 3. LRA Section B.3.37 states an enhancement to "parameters monitored or inspected" program element. The applicant stated that this enhancement is needed to include elastomer inspections for deterioration of seals leading to loss of sealing and leakage through containment penetrations.

Based on its review, the staff finds this enhancement acceptable because when the enhancement is implemented the applicant's Structures Monitoring Program will be consistent with the recommendations of GALL AMP XI.S5 and provide assurance that the effects of aging will be adequately managed.

Enhancements 4 and 5. LRA Section B.3.37 states an enhancement to "detection of aging effects" program element. The applicant stated that this enhancement is needed to include a requirement for contacting the proper personnel to allow for an opportunistic inspection of the buried concrete foundation. The LRA further states an enhancement to include an evaluation of opportunistic inspections of buried concrete foundations on a 10-year basis.

While reviewing the "detection of aging effects" program element, the staff noted that the LRA states the Structures Monitoring Program has an inspection interval of 5 or 10 years, depending on the environment, plus or minus 1 year. However, the GALL AMP XI.S6 program states that inspection schedules should be commensurate with industry codes and mentions ACI 349.3R-96, which discusses inspections at 5- or 10-year intervals. GALL AMP XI.S7 references RG 1.127 and an inspection interval of no more than 5-years. Neither the GALL AMPs XI.S6 or XI.S7 nor the referenced documents mention a 1-year extension on the inspection interval. By letter dated September 14, 2009, the staff issued RAI B.3.37-1, requesting that the applicant justify the 1-year extension of the Structures Monitoring Program inspection interval.

In its response dated October 13, 2009, the applicant stated that the 10-year limit in ACI 349 is not an absolute upper time limit and the ability to extend a 10-year interval by up to 1 year is important to meet practical needs of outage scheduling. The applicant further explained that consistent with ACI 349.3R, Chapter 6, its program provides for two inspections to be accomplished in a 10-year period (at the five plus or minus 1-year frequency) for structures exposed to natural environment, structures inside primary containment, continuous fluid-exposed structures, and structures retaining fluid and pressure; and one inspection each 10 plus or minus 1 years (also stated in DAEC procedures as two each 20 years) for the below-grade structures and controlled interior-environment structures. The applicant further stated that plant operating experience supports the adequacy of the inspection interval.

Based on its review, the staff finds the applicant's response to RAI B.3.37-2 unacceptable because it did not clearly explain which structure/environment combinations were inspected with a 10-year interval. Therefore, by letter dated February 22, 2010, the staff issued follow-up RAI B.3.37-1, requesting the applicant to provide a list of structures that are and will be inspected on a 10-year interval, along with their environment and operating experience.

By letter dated March 9, 2010, the applicant provided a list of in-scope structures as well as the environments they are exposed to. The environments were classified as harsh or mild, and the applicant explained each classification. The applicant further explained that all structures exposed to a "harsh" environment, including structures within primary containment and structures exposed to a natural environment, are inspected on a 5-year interval. All other structures are inspected on a 10-year interval.

The staff reviewed the applicant's response and found it acceptable because it explains what is meant by a harsh environment and which structures are located in a harsh environment. It also explained that the inspection intervals align with the recommendations of industry standards and guidance. The staff's concern in follow-up RAI B.3.37-1 is resolved.

On the basis of its review, the staff finds this enhancement acceptable because, when it is implemented prior to the period of extended operation, the Structures Monitoring Program will be consistent with the suggestions in the GALL Report and provide assurance that the effects of aging will be adequately managed.

<u>Operating Experience</u>. LRA Section B.3.37 summarizes operating experience related to the Structures Monitoring Program. The staff reviewed operating experience information in the application and during the audit to determine whether the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant and are evaluated in the GALL Report. As discussed in the Audit Report, the staff conducted an independent search of the plant operating experience information to determine whether the applicant had adequately incorporated and evaluated operating experience related to this program.

During its review, the staff identified operating experience which could indicate that the applicant's program may not be effective in adequately managing aging effects during the period of extended operation. The staff determined the need for additional clarification, which resulted in the issuance of an RAI.

The applicant stated that its spent fuel pool has been leaking since at least 1994 and the leakage has been contained within the fuel pool liner drain system. By letter dated September 14, 2009, the staff issued RAI B.3.37-3, requesting the applicant verify, through chemical analysis, that the leakage detected in the drain system originated in the spent fuel pool. The staff also requested the applicant to discuss the basis for concluding that the leakage was contained within the drain system.

In its response dated October 14, 2009, the applicant stated that chemical analysis is not sufficient to confirm or disprove that the source of the leakage is the spent fuel pool; however, no other source is plausible. The applicant further stated that walkdowns have been completed in accessible areas under the pool and no leaks have been discovered.

The staff reviewed the applicant's response and finds it acceptable because, the applicant has performed inspections to detect leakage outside of the spent fuel pool liner drain systems. These inspections have not found any indications of leakage. These inspections will continue to be conducted during the period of extended operation, and any future signs of degradation will be entered into the corrective action program. The staff's concern described in RAI B.3.37-3 is resolved.

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

<u>UFSAR Supplement</u>. LRA Section A.18.1.37 provides the UFSAR supplement for the Structures Monitoring Program. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.5-2.

The staff also notes that the applicant committed (Commitment Nos. 30-34) to enhance the Structures Monitoring Program prior to entering the period of extended operation. Specifically, the applicant committed to the following:

- Enhance procedures to include structures and structural components not currently in Maintenance Rule Program.
- Enhance procedures to include periodic sampling of groundwater for pH, chloride, and sulfate concentration on a 5-year periodicity.
- Enhance procedures to include an elastomer inspection to prevent leakage through containment penetration.
- Enhance procedures to include a requirement to contact the proper personnel to allow opportunistic inspection of the buried concrete foundation.
- Enhance procedures to include opportunistic inspections of the buried concrete foundation on a 10-year periodicity.

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

<u>Conclusion</u>. On the basis of its audit and review of the applicant's Structures Monitoring Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements

and confirmed that their implementation through Commitment Nos. 30 through 34 prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2.12 Metal Fatigue of Reactor Coolant Pressure Boundary Program

Summary of Technical Information in the Application. LRA Section B.4.2 describes the existing Metal Fatigue of Reactor Coolant Pressure Boundary Program as consistent with GALL AMP X.M1, “Metal Fatigue of Reactor Coolant Pressure Boundary.” The applicant stated that it has evaluated the environmental effects on fatigue usage for the applicable components in accordance with NUREG/CR-6260 and the results show that the environmentally adjusted fatigue usage of all components/locations that were evaluated is within the design limit of 1.0 for 60 years of plant operation.

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

The staff compared elements one through six of the applicant’s program to the corresponding elements of GALL AMP X.M1. As discussed in the Audit Report, the staff confirmed that each element of the applicant’s program is consistent with the corresponding element of GALL AMP X.M1, with the exception of the “preventive action” and “monitoring and trending” program elements. The staff also determines the need for additional clarification in areas regarding procedures for transient tracking. For these elements and areas, the staff determines the need for additional clarification, which resulted in the issuance of RAIs.

The staff noted that the applicant’s program relies on transient cycle monitoring to evaluate the fatigue usage described in the LRA. However, the staff noted there was no information regarding how the applicant has been and will be monitoring the severity of pressure and temperature (P-T) activities during plant operations. The staff noted that it is essential that all thermal and pressure transients are bounded by the design specifications (including P-T excursion ranges and temperature rates) for an effective and valid AMP. By letter dated September 14, 2009, the staff issued RAI B.4.2-1 requesting the applicant to: (1) describe the procedures that it uses for tracking thermal transients and confirm that all monitored transient events were bounded by the design specifications, (2) confirm that transient events were continuously monitored since the plant startup, and (3) provide a histogram of cycles accrued for the plant startup/shutdown.

In its response dated October 13, 2009, the applicant responded to RAI B.4.2-1, Part 1 by stating that its program tracks thermal transients with an STP that is performed on a cyclic basis. The applicant stated that the cycles are manually counted by reviewing various plant documents, including operator logs, maintenance rule data, and computer printouts; and that the data of the plant response to the actual transient are compared against the design transients to determine the type of transient events and are then “binned” accordingly.

Based on its review, the staff finds the applicant's response to RAI B.4.2-1, Part 1, acceptable because the applicant provided the information requested and the STP provides the necessary guidance for the responsible engineer to perform thermal event categorization and accumulate the event counts in the appropriate "bins" for the type of transient events. The staff's concern described in RAI B.4.2-1, Part 1 is resolved.

In its response dated October 13, 2009, the applicant responded to Part 2 by stating that actual transient monitoring and cycle tracking activities began in 1998. The applicant stated that a thorough review of the past records and documents was performed to determine the number of cycles that had occurred for all type of transients since the plant began operation until the use of its STP. The applicant further stated that this served as a "starting point" for the cycles that were accrued after 1998 when the STP became available. The staff noted that the applicant's review of its operator logs and historical plant records is capable of identifying the occurrence of these transients. By letter dated February 2, 2010, the applicant supplemented its response to RAI B.4.2-1, Part 2, in which it stated its technical specifications have contained P-T operating limits, including a 100 °F/hr heatup/cooldown rate limit, since initial plant startup. The applicant further stated that events such as startups, shutdowns, and significant transients, including the exceedance of technical specification limits, would have been documented in operator logs. The applicant stated that during this reassessment, no actual transients were identified which exceeded the bounds of the design transients. The staff noted the applicant's reassessment serves as a proper baseline for its STP because the actual transients that occurred prior to the STP were bounded by the design transients.

Based on its review, the staff found that the applicant's response reasonable because: (1) the applicant's technical specifications, which were in effect prior to the institution of STPs, also contain valid procedures and instructions to ensure appropriate method of transient monitoring and cycle counting; (2) the histogram shows a faster cycle accumulation rate for the period prior to 1998 than the rate after 1998, which is consistent with better operating procedures; (3) the applicant performed a detailed review of its operator logs and historical plant records to determine the starting point for its STP and cycle counting; and (4) during the applicant's reassessment it was confirmed that the design transients bounded any actual transients that had occurred and were used at the baseline for the STP. The staff's concern described in RAI B.4.2-1, Part 2 is resolved.

In its response dated October 13, 2009, the applicant responded to Part 3 by providing the histogram for the startup transients. The applicant stated that the number of shutdowns is equal to the number of startups on a cyclic basis, but not a yearly basis (shutdown cycles are less than the heatup cycles, by one cycle).

Based on its review, the staff finds the applicant's response to RAI B.4.2-1, Part 3, acceptable because the applicant provided the requested transient cycle histogram, and the histogram shows conservative cycle accumulation rates. The staff's concern described in RAI B.4.2-1, Part 3 is resolved.

The staff noted that the program description does not address the actions to monitor thermal activities, transient cycles, and fatigue usage. The staff further noted that the program description focused on presenting the results of environmental fatigue evaluations. By letter dated September 14, 2009, the staff issued RAI B.4.2-3 requesting that the applicant consider including monitoring/tracking of transient cycles and fatigue usage in the program description.

In its response dated October 13, 2009, the applicant amended its LRA so that the first paragraph of the program description reads as follows:

> The DAEC Metal Fatigue of Reactor Coolant Pressure Boundary Program is an existing program. The Program tracks the number of thermal and pressure transients for selected reactor coolant system components, in order not to exceed design limits on fatigue usage. The program ensures the validity of analyses that explicitly assumed a fixed number of thermal and pressure transients by assuring that the actual number of transients does not exceed the assumed limit. In accordance with NUREG/CR-6260, the impact of environmental effects on fatigue usage have been evaluated and shown to be less than the maximum allowable (1.0) for the sixty (60) year license renewal term of operation.

Based on its review, the staff finds the applicant's response to RAI B.4.2-3 acceptable because the applicant's revisions to its program description are consistent with the recommended program description in GALL AMP X.M1. The staff's concern described in RAI B.4.2-3 is resolved.

During its audit, the staff noted the "detection of aging effects" program element of the applicant's program states that it only tracks cycles. The staff noted that tracking cycles alone is insufficient in situations where an unanticipated event occurs or when component geometries are changed. The staff further noted that under these circumstances, the stress state is most likely changed which will affect the fatigue usage. By letter dated September 14, 2009, the staff issued RAI B.4.2-4 requesting the applicant describe how its program would address fatigue in the case where unanticipated situations such as structural configuration changes or unexpected transients occur.

In its response dated October 13, 2009, the applicant stated that in the event of structural configuration changes, the modification process ensures that ASME requirements, including the evaluation of stresses and fatigue, are addressed. The applicant further stated that should discrepancies be identified in the design of vessel components or piping systems, they would be addressed by the corrective action program, and the resolution would include an evaluation of fatigue usage, if required. The applicant also stated that should unexpected transients occur the situation would also be evaluated by the corrective action program. The applicant stated that one example is described in LRA Section B.4.2.5, Operating Experience.

Based on its review, the staff finds the applicant's response to RAI B.4.2-4 acceptable because the applicant provided the information requested, and that if a structural configuration changes or unexpected transient occurs the applicant's corrective action program may require evaluations to address fatigue usage. The staff noted through its experience in dealing with the reactor vessel bottom head drain tube incident that occurred in June 2000, the applicant has demonstrated the ability of taking appropriate corrective actions to ensure the intended functions and structural integrity of the components being maintained. The staff's concern described in RAI B.4.2-4 is resolved.

The staff also reviewed the portions of the "scope of the program" program element associated with the enhancement to determine whether the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of these enhancements follows.

Enhancement. LRA Section B.4.2 states an enhancement to the "scope of the program" program element. The applicant stated its program will be enhanced to incorporate requirements for inclusion of NUREG/CR-6260 locations in the implementing procedure for the Metal Fatigue of Reactor Coolant Pressure Boundary Program.

The staff noted the "scope of the program" program element of GALL AMP X.M1 states "The program includes preventive measures to mitigate fatigue cracking of metal components of the RCPB caused by anticipated cyclic strains in the material." The staff noted that the NUREG/CR-6260 locations are subjected to fatigue cracking in the RCPB caused by anticipated cyclic strains in the material. The staff noted that the inclusion of these components in the applicant's implementing procedures will provide preventive measures to mitigate fatigue cracking of these NUREG/CR-6260 locations.

Based on its review, the staff finds this enhancement acceptable because the applicant will include the NUREG/CR-6260 locations in its implementing procedure to provide preventive measures to mitigate fatigue cracking, consistent with the recommendations of GALL AMP X.M1.

Based on its audit, and review of the applicant's response to RAI B.4.2-1, RAI B.4.2-3, and RAI B.4.2-4, the staff finds that elements one through six of the applicant's Metal Fatigue of Reactor Coolant Pressure Boundary Program are consistent with the corresponding program elements of GALL AMP X.M1 and, therefore, acceptable.

Operating Experience. LRA Section B.4.2 summarizes operating experience related to the Metal Fatigue of Reactor Coolant Pressure Boundary Program. The applicant stated that in June 2000, a scram occurred as a result of a generator perturbation, which caused the reactor recirculation flow to cease, which in turn resulted in a rapid local temperature decrease in the reactor bottom head drain line to RWCU. The applicant stated that it performed evaluations to assess the effects and concluded that the incident resulted in no concerns in fatigue usage. During its audit, the staff reviewed the onsite technical information and confirmed that fatigue usage related to the incident is negligible.

The applicant stated that during the Cycle 19 startup (April 2003) a concern was identified that additional reactor vessel fatigue was incurred because of prolonged operation at low power with feedwater heaters out of service, and then in November of 2003 a similar concern was identified when the plant was operating at very low reactor power in support of troubleshooting condenser air in-leakage. The applicant stated that these concerns were addressed in the corrective action program. During its audit, the staff reviewed the program basis document and confirmed that the applicant had taken corrective actions and performed a follow-up analysis, which concluded that the limits established in the STP had not been exceeded. The staff determines that the applicant appropriately took corrective actions and evaluated the impact of the incident.

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

During its review, the staff identified operating experience which could indicate that the applicant's program may not be effective in adequately managing aging effects during the period of extended operation. The staff determined the need for additional clarification, which resulted in the issuance of RAIs.

LRA Section B.4.2.5 states that inconsistencies in RPV fatigue cycle assumptions were identified in November 2006 during a review of RPV and piping calculations. The applicant stated that this issue was addressed in the corrective action program. However, the LRA does not discuss the effects of the inconsistencies on the fatigue results. By letter dated September 14, 2009, the staff issued RAI B.4.2-2 requesting that the applicant summarize the corrective actions taken and the impact of the transient cycle inconsistencies on the fatigue results.

In its response dated October 13, 2009, the applicant stated that the 1998 reassessment revised UFSAR Table 5.3-7, but did not revise all design documents. The applicant stated that this contributed to the discrepancies between the power uprate fatigue evaluation (performed in 2000) and the 1998 reassessment. The applicant stated that the power uprate evaluations did not use the revised cycle counts of the 1998 reassessment, but did use revised stresses due to the uprate. The applicant further stated that the 1998 reassessment used the revised cycle counts, but used pre-uprate stresses. For its LRA, the applicant stated that it appropriately used the correct number of transient cycles along with the post-uprate stresses for the fatigue analyses and claimed that the inconsistencies discussed in LRA Section B.4.2.5 have no impact on the 60-year fatigue evaluation results.

Based on its review, the staff finds the applicant’s response to RAI B.4.2-2 acceptable because the applicant provided the information requested, and explained the details of the transient cycle inconsistency issue and confirmed that the issue with the inconsistency does not have an impact on the 60-year fatigue evaluation results. The staff’s concern described in RAI B.4.2-2 is resolved.

LRA Section B.4.2.5 states that in 2007, a nuclear oversight evaluator found that procedural direction did not exist to record cumulative time spent in a hot-standby condition. The applicant stated that this issue was addressed in accordance with its corrective action program. During its audit, the staff reviewed the applicant’s program basis document which states that after its investigation, it was concluded that the hour count capturing requirement was missing from the procedure. However, the program basis document did not provide a discussion as to what extent the lacking of hour and minute portion of the time records would impair the accuracy of the monitored transient data. By letter dated October 16, 2009, the staff issued RAI B.4.2-5 requesting that the applicant provide the operating period during which this issue existed and to provide a justification that the monitored transients are valid during this period.

In its response dated November 16, 2009, the applicant stated that a nuclear oversight assessor noticed that Revision 5 (effective date September 28, 2005) of STP (which contains the procedural direction for counting transient cycles experienced by the reactor vessel) contains a requirement for recording the hours spent in a hot standby/shutdown condition, but STP Revision 6 (effective date January 25, 2007) did not contain such a requirement. The applicant stated that the requirement was put back into the STP in Revision 9 (effective date June 5, 2007). Therefore, the applicant has concluded that the potential improper data recording lasted approximately five months, from January 25, 2007 to June 5, 2007. Regarding the validity of the transient data recorded during the affected period, the applicant stated that it has reviewed the transient events that occurred from 2005 through 2007 to ensure that, if additional hours in hot standby/shutdown had occurred, they would be added to the cumulative total, and the review concluded that there were no events resulting in additional hours in hot standby during the spring 2007 RFO. The applicant has concluded that the issue was resolved with no loss of data regarding the hours in hot standby.

Based on its review, the staff finds the applicant's response to RAI B.4.2-5 acceptable because the applicant provided the information requested and took the necessary corrective actions, and has determined that this incident did not result in events resulting in additional hours in hot standby during the spring 2007 RFO. The staff's concern described in RAI B.4.2-5 is resolved.

LRA Section B.4.2.5 states that in June 2000 and November 2006 the reactor bottom head and drain line pipe experienced rapid temperature drops related to reactor scrams. Although the applicant stated that it has taken corrective actions there was no indication as to whether a fatigue analysis has been performed.

By letter dated October 16, 2009, the staff issued RAI B.4.2-6 requesting that the applicant: (1) clarify whether a follow-up fatigue analysis was performed for the November 2006 incident and (2) summarize the status of the applicant's plan of tracking thermal cycles for the attached piping.

In its response dated November 16, 2009, the applicant stated that for both the 2000 and 2006 events, startup/shutdown rates greater than 100 °F/hr were determined to have occurred in the bottom head drain piping, but not in the vessel bottom head or bottom head drain nozzle. The applicant further stated that since the vessel did not experience excessive startup/shutdown rates, follow-up fatigue analyses for the vessel were not needed. The applicant further stated that they have performed a review of the Class 1, ANSI B31.7 piping fatigue analysis, which shows that the piping has been qualified for a much more severe transient and many more cycles. The applicant has concluded that no thermal transient monitoring is required for this piping.

Based on its review, the staff finds the applicant's response to RAI B.4.2-6 acceptable because: (1) the applicant provided the information requested and the 100 °F per hr ASME Code limit applies to the reactor vessel region only and the temperature rates experienced by the reactor vessel bottom head and nozzle are within the Code limit, therefore, no additional fracture mechanics or fatigue evaluation were required; and (2) the applicant has performed a review of the existing fatigue analysis and determined that the piping of concern is capable of withstanding much more severe thermal conditions and many more cycles. The staff's concern described in RAI B.4.2-6 is resolved.

Based on its audit and review of the application, and review of the applicant's responses to RAIs B.4.2-5 and B.4.2-6, the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and that implementation of the program has resulted in the applicant taking appropriate corrective actions. The staff confirmed that the "operating experience" program element satisfies the criterion in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

UFSAR Supplement. LRA Section A.18.3.2 provides the UFSAR supplement for the Metal Fatigue of Reactor Coolant Pressure Boundary Program. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.1-2.

The staff also notes that the applicant committed (Commitment No. 35) to enhance the Metal Fatigue of Reactor Coolant Pressure Boundary Program prior to entering the period of extended operation. Specifically, the applicant committed to enhance its procedures to incorporate the requirements of NUREG/CR-6260 locations into the implementing procedures.

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

Conclusion. On the basis of its audit and review of the applicant's Metal Fatigue of Reactor Coolant Pressure Boundary Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. Also, the staff reviewed the enhancements and confirmed that their implementation through Commitment No. 35, 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, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3 AMPs Not Consistent With or Not Addressed in the GALL Report

In LRA Appendix B, the applicant identified the following AMPs as plant-specific:

- Electrical Connections Program
- Electrical Penetration Assemblies Program
- Small Bore Piping Program

For AMPs not consistent with or not addressed in the GALL Report the staff performed a complete review to determine their adequacy to monitor or manage aging. The staff's review of these plant-specific AMPs is documented in the following sections.

3.0.3.3.1 Electrical Connections Program

Summary of Technical Information in the Application. LRA Section B.3.19 describes the new Electrical Connections Program as plant-specific. The applicant stated that its program calls for a one-time inspection of electrical connections. The applicant stated that this AMP for electrical connections accounts for loosening of connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation. The applicant also stated that a sample of electrical connections will be selected based on factors such as voltage level (high, medium, and low voltage), circuit loading (high load), location (adverse localized environment), and plant operating experience. The applicant further stated that, if the one-time inspection shows that an aging effect exists, a periodic inspection program will be established. LRA Table 3.6.1, item 3.6.1-13 identifies the applicant's Electrical Connections Program as not consistent with the GALL report and that the new plant-specific Electrical 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."

Staff Evaluation. The staff reviewed program elements one through six of the applicant's program against the acceptance criteria for the corresponding elements as stated in SRP-LR Section A.1.2.3. The staff's review focused on how the applicant's program manages aging effects through the effective incorporation of these program elements.

The staff issued GALL AMP XI.E6, dated September 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 operating experience 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 operating experience identified only a limited number of failed connections due to aging and that operating experience 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 GALL 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 recommended a sample-based, one-time inspection program. The staff concluded that a one-time inspection program was adequate to ensure that either aging of metallic cable connections does not occur and/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 the applicant's basis document.

The staff's evaluation of each of these elements follows.

Scope of the Program. LRA Section B.3.19 states that external connections terminating at active or passive devices are in the scope of this program. The applicant stated its program applies to bolted electrical connections that support a license renewal intended function and that are susceptible to aging due to loose connections resulting from thermal cycling, ohmic heating, or electrical transients. The applicant further stated that the electrical connections within scope includes external connections terminating at active and passive components, terminal strips in passive components, bolted fuse holders in passive components and bolted connections between cables. This program does include high-voltage (greater than 35 kV) switchyard connections. The program does not include connections internal to active components and connections within the scope of its EQ Program. The applicant further stated that the insulating material of any connection is addressed in the Electrical Cables and Connection Program.

The applicant identified the specific components for which the program manages the aging effects as non-EQ metallic parts of cable connections within the scope of license renewal. The applicant stated that wiring connections internal to an active assembly are considered a part of the active assembly and, therefore, not within the scope of this program. The identified components meet the criteria of SRP-LR Appendix A.1.2.3.1 and ISG LR-ISG-2007-2. The staff noted that this program includes high-voltage (greater than 35 kV) switchyard connections, and bolted cable connections covered under 10 CFR 50.49 are excluded. The inclusion of high-voltage connections is consistent with GALL AMP XI.E6. The exclusion of 10 CFR 50.49

bolted cable connections is also acceptable based on GALL AMP XI.E6 and ISG LR-ISG-2007-2.

The staff confirmed that the "scope of the program" program element satisfies the criteria defined in GALL AMP XI.E6, ISG LR-ISG-2007-2, and SRP-LR Section A.1.2.3.1 and, therefore, the staff finds it acceptable.

Preventive Actions. LRA Section B.3.19 states that the Electrical Connections Program does not include any action to prevent or mitigate aging 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 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 GALL AMP XI.E6, ISG LR-ISG-2007-02, and in SRP-LR Section A.1.2.3.2 and, therefore, the staff finds it acceptable.

Parameters Monitored or Inspected. LRA Section B.3.19 states that the Electrical Connections Program focuses on the loosening of bolted connections of high resistance connections. The applicant also stated that the program focuses on the metallic parts of the connection.

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 parameters monitored or inspected should detect the presence and extent of aging effects and that the parameters to be monitored or inspected should be identified and linked to the degradation of the particular structure and component 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. 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 utilizing a representative sample 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 criterion defined in SRP-LR Section A.1.2.3.3 and, therefore, the staff finds it acceptable.

Detection of Aging Effects. LRA Section B.3.19 states that the Electrical Connections Program will perform a one-time inspection (i.e., thermographic) on a selected sample of electrical connections. The applicant further stated a representative sample of electrical connections within the scope of license renewal will be tested at least once prior to the period of extended operation to confirm that there are no AERMs during the period of extended operation. Furthermore, the one-time inspection provides additional confirmation to support industry operating experience that shows electrical connections have not experienced a high degree of failures, and that existing installation and maintenance practices are effective. The results of the one-time inspection will be used to confirm that an aging effect of loosening of electrical connections due to differential heating does not exist.

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 structure and component intended functions. The parameters to be monitored or inspected should be appropriate to ensure that the structure or component will be adequately maintained for license renewal 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 operating experience. 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 confirmed in LRA Section B.3.19 that inspection methods include thermography. In the development of ISG LR-ISG-2007-02, the staff concluded 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.

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 referenced technical basis is consistent with either GALL AMP XI.E6 or ISG LR-ISG-2007-02 and is, therefore, acceptable.

The staff confirmed that the "detection of aging effects" program element satisfies the criteria defined in GALL AMP XI.E6, ISG LR-ISG-2007-02, and in SRP-LR Section A.1.2.3.4 and, therefore, the staff finds it acceptable.

Monitoring and Trending. LRA Section B.3.19 states the Electrical Connection Program does not include trending because it is a one-time inspection program and any trending performed will be part of the corrective action program trending.

The staff reviewed the applicant's "monitoring and trending" program element against the criteria in SRP-LR Section A.1.2.3.5, which states that monitoring and trending activities should be described, and should provide predictability of the extent of degradation, and thus lead to 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.

The staff noted that GALL AMP XI.E6 and ISG LR-ISG-2007-02 both state that trending actions are not part of this program.

The staff confirmed that the "monitoring and trending" program element satisfies the criteria defined in GALL AMP XI.E6, ISG LR-ISG-2007-02, and in SRP-LR Section A.1.2.3.5 and, therefore, the staff finds it acceptable.

Acceptance Criteria. LRA Section B.3.19 states the acceptance criteria for each test are defined for the specific type of test performed and the specific type of cable connections tested.

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 structure and component 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 for the one-time test acceptance criteria for each test, when implemented, to 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 license renewal intended functions can be maintained consistent with the CLB.

The staff confirmed that the "acceptance criteria" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.6 and, therefore, the staff finds it acceptable.

Operating Experience. LRA Section B.3.19 summarizes operating experience related to the Electrical Connections Program. The applicant stated that industry operating experience has shown that circuits exposed to appreciable ohmic or ambient heating during operation may experience loosening of connections. The applicant stated the Electrical Connections Program is a new program and does not yet have any operating experience. The applicant stated that plant and industry operating experience will be considered when developing the programmatic documents. The applicant also stated that operating experience that forms the basis for the program is described in the operating experience element of GALL AMP XI.E6. The applicant further stated that plant-specific operating experience is consistent with the operating experience in the GALL AMP XI.E6 program description. The applicant also stated that the "operating experience" program element will be used to provide industry feedback to this AMP. The applicant stated that loose or corroded connections have been identified during thermographic monitoring, routine maintenance activities, and as a result of failure of equipment. However, the applicant stated that a causal analysis was not performed on all of the loose connections, so it is not known if the loose electrical connections were the result of aging.

The staff reviewed this information against the acceptance criteria in SRP-LR Section A.1.2.3.10, which states that information should be provided that is objective evidence to support the conclusion that the effects of aging will be adequately managed so that the structure and component intended functions will be maintained during the period of extended operation.

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

UFSAR Supplement. LRA Section 18.1.19 provides the UFSAR supplement for the Electrical Connections Program. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Sections 3.6.2.4 and 3.6.3.4, as modified by ISG LR-ISG-2007-02. The staff also confirmed that the applicant's UFSAR supplement is consistent to SRP-LR Table 3.6.2, as modified by ISG LR-ISG-2007-02.

The staff also notes that the applicant committed (Commitment No. 6) to implement the new Electrical Connections Program prior to entering the period of extended operation for managing aging of applicable components.

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

Conclusion. On the basis of its technical review of the applicant's Electrical Connections 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, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.2 Electrical Penetration Assemblies Program

Summary of Technical Information in the Application. LRA Section B.3.20 describes the new Electrical Penetration Assemblies Program as plant-specific. The applicant stated its program manages the effects of aging due to moisture intrusion degrading the IR of the epoxy in the electrical penetration assembly (EPA). The applicant stated that the Electrical Penetration Assemblies Program consists of existing maintenance activities that were established as a result of plant operating experience. The applicant stated that the EPAs that support a license renewal intended function are included in the scope of this program. The program does not include EPAs that are within the EQ Program. The applicant also stated that the Electrical Penetration Assemblies Program manages the effects of aging by inspecting the EPAs periodically. The applicant further stated that the inspections are identical to the required maintenance for the EPAs within the scope of the EQ Program. LRA Section B.3.20.1 states that it experienced two previous failures of EPAs as documented below.

An analysis of one EPA was performed. The analysis concluded that the failure was due to moisture, a random void, and potential difference between conductors with subsequent growth of dendrites between conductors. The dendrites formed a low resistance path, over a long period of time, for current leakage, arcing and carbonization of the epoxy. The electrical short finally developed when the carbonized path between conductors became continuous and resulted in shorting between splices of the two conductors. The moisture could have been due to less-than-adequate adherence to manufacturer instructions which required internal nitrogen pressure be maintained in the assemblies. Dendrite formation requires the presence of moisture.

The applicant stated that the analysis found dendrites in the EPA. The applicant also stated that the analysis of this failure was sufficient to identify the other EPA failure. Both EPA assemblies were replaced by the applicant.

The applicant concluded that the Electrical Penetration Assemblies Program will provide reasonable assurance that the effects of aging will be managed such that the applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

Staff Evaluation. The staff reviewed program elements one through six of the applicant's program against the acceptance criteria for the corresponding elements as stated in SRP-LR Section A.1.2.3. The staff's review focused on how the applicant's program manages aging effects through the effective incorporation of these program elements. The staff's evaluation of each of these elements follows.

Scope of the Program. LRA Section B.3.20 states the program applies to EPAs that support a license renewal intended function and are susceptible to moisture aging effects on the epoxy in the EPA. The applicant further stated that all 16 of the EPAs in the drywell have a license renewal intended function. Seven of the EPAs in the drywell are within the scope of the EQ Program and are, therefore, outside the scope of this program. The other nine EPAs in the drywell are within the scope of this program. The applicant also stated that the torus EPA and the drywell airlock EPAs do not have a license renewal intended electrical function.

The staff reviewed the applicant's "scope of the program" program element against the criteria in SRP-LR Section A.1.2.3.1, which states that the program should include the specific structures and components for which the program manages aging.

The applicant identified the specific commodity groups for which the program manages the aging effects as EPAs that support a license renewal intended function and are susceptible to moisture aging effects on the epoxy in the EPA within the scope of license renewal. The applicant's EPAs within the scope of the EQ Program are outside the scope of this program.

The staff reviewed the applicant's "scope of the program" program element against the criteria in SRP-LR Section A.1.2.3.1, which states that the specific program necessary for license renewal should be identified and should include the specific structures and components which the program manages aging. The identified commodity groups identified in LRA Section B.3.20.5 meet the criteria of SRP-LR Appendix A.1.2.3.1.

The staff confirmed that the "scope of the program" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.1 and, therefore, the staff finds it acceptable.

Preventive Actions. LRA Section B.3.20 states the program consists of preventive actions only. The applicant also stated inspections will be performed to ensure that the nitrogen pressure is not allowed to reach atmospheric pressure and the program includes monthly checks of the nitrogen pressure. The applicant stated that this will ensure that moisture will not enter the penetration and prevents the only aging effect mechanism which is moisture degrading the insulation properties of the epoxy.

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 activities for prevention and mitigation programs should be described and these actions should mitigate or prevent aging degradation.

The staff noted that the applicant's program includes monthly checks to ensure that moisture will not enter the penetration and the aging effect of concern is moisture degrading the insulation properties of the EPA epoxy. The staff noted that the "preventive actions" program element incorporates the aging mechanism identified through industry and plant experience.

The staff confirmed that the "preventive actions" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.2 and, therefore, the staff finds it acceptable.

Parameters Monitored or Inspected. LRA Section B.3.20 states the program will inspect the nitrogen pressure of the assembly monthly and this will ensure that moisture will not enter the penetration. The applicant further stated the only aging effect mechanism is moisture degrading the insulation properties of the epoxy.

The staff reviewed the applicant's "parameters monitored or inspected" program element against the criteria in SRP-LR Section A.1.2.3.3, which states that the parameters monitored or inspected should be identified and linked to the degradation of the particular structure or component intended function and that for prevention and mitigation program elements, the parameters monitored should be specific parameters being controlled to achieve prevention or mitigation of aging effects.

The staff confirmed that the "parameters monitored or inspected" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.3 and, therefore, the staff finds it acceptable.

Detection of Aging Effects. LRA Section B.3.20 states the program checks nitrogen pressure on a monthly basis and this will ensure that moisture will not enter the penetration. The applicant further stated the only aging effect mechanism is moisture degrading the insulation properties of the epoxy.

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 structure and component intended functions. Furthermore, the parameters to be monitored or inspected should be appropriate to ensure the structure and component intended functions will be adequately maintained for license renewal under all CLB design conditions. It also states that the program element describes "when," "where," and "how" the program data are collected and that the method and technique and frequency may be linked to plant-specific or industry-wide operating experience.

The staff noted that the applicant's analysis of the plant penetration failure concluded that the EPA failure was due to moisture intrusion. The staff further noted that monitoring the nitrogen pressure provides reasonable assurance that this aging effect will be controlled. The staff noted that the EPA inspection frequency is stated as monthly and is the result of plant-specific and industry operating experience.

The staff confirmed that the "detection of aging effects" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.4 and, therefore, the staff finds it acceptable.

Monitoring and Trending. LRA Section B.3.20 states the program does not include trending and that any trending performed will be part of the corrective action program trending. 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.

The staff noted that the acceptance criterion is based on acceptable nitrogen pressure range to maintain positive pressure in the penetration. The staff further noted that trending is not used in the program except as may be performed under the applicant's corrective action program.

The staff confirmed that the "monitoring and trending" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.5 and, therefore, the staff finds it acceptable.

Acceptance Criteria. LRA Section B.3.20 states the acceptance criterion for the nitrogen pressure is between 30 and 50 pounds per square inch, gauge (psig) on the pressure gauge for the penetration. The applicant further stated that this criterion is listed in the appropriate site procedures and the 30 to 50 psig range ensures that the EPA maintains a positive pressure at all times. Furthermore, the other maintenance activities listed in the vendor manual do not address the moisture aging effects on the epoxy in the EPA.

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. Furthermore, the acceptance criteria, against which the need for corrective actions will be evaluated, should ensure that the structure and component intended functions(s) are maintained under all CLB design conditions during the period of extended operation.

The staff noted that this program element specifies specific acceptance criteria of 30 and 50 psig on the pressure gauge for the penetration to ensure that the EPA maintains a positive pressure at all times.

The staff confirmed that the "acceptance criteria" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.6 and, therefore, the staff finds it acceptable.

Operating Experience. LRA Section B.3.20 summarizes operating experience related to the Electrical Penetration Assemblies Program. The applicant stated that the Electrical Penetration Assemblies Program is a new program and, therefore, there is no plant-specific operating experience for this program. The applicant also stated that plant operating experience forms the basis of the program and that industry and plant-specific operating experience will be evaluated in the development and implementation of this program. The applicant stated that past inspections and monitoring activities have revealed degraded epoxy IR due to moisture intrusion. The applicant further stated that these issues were documented and addressed using the corrective action program which resulted in the replacement of the two failed EPAs. The applicant's basis document states that both failures were due to not adequately implementing the aging management instructions provided by the vendor. The applicant also noted that no other penetration assemblies have failed since periodic inspections were started.

The staff reviewed this information against the acceptance criteria in SRP-LR Section A.1.2.3.10, which states that information should be provided that is objective evidence to support the conclusion that the effects of aging will be adequately managed so that the structure and component intended functions will be maintained during the period of extended operation.

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

UFSAR Supplement. LRA Section 18.1.20 provides the UFSAR supplement for the Electrical Penetration Assemblies Program. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Sections 3.6.2.4 and 3.6.3.4.

The staff also notes that the applicant committed (Commitment No. 7) to implement the new Electrical Penetration Assemblies Program prior to entering the period of extended operation for managing aging of applicable components.

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

Conclusion. On the basis of its technical review of the applicant's Electrical Penetration Assemblies 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, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.3.3 Small Bore Piping Program

Summary of Technical Information in the Application. LRA Section B.3.40 describes the new ASME Code Class 1 Small Bore Piping Inspection Program as plant-specific. The applicant stated that the program is applicable to small bore ASME Code Class 1 piping butt welds and socket welds less than 4 inches of nominal pipe size (NPS). The applicant stated that for its small bore socket welds, it will perform inspection per Code requirements as specified in IWB-2500-1 Category B-P. The applicant also stated that volumetric examinations will be performed on selected butt welds

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 was on how the applicant's program manages aging effects through the effective incorporation of these program elements. The staff's evaluation of each of these elements follows.

Scope of the Program. LRA Section B.3.40 states that the ASME Code Class 1 Small Bore Piping Inspection Program manages the aging effects for small bore ASME Code Class 1 less than 4 inches NPS.

The staff reviewed the applicant's "scope of the program" program element against the criteria in SRP-LR Section A.1.2.3.1, which states that the specific program necessary for license renewal should be identified and that the scope of the program should include the specific structures and components of which the program manages the aging.

The staff confirmed that specific systems/components that are subject to the ASME Code Class 1 Small Bore Piping Inspection are identified in the LRA including small bore butt welds and socket welds.

The staff confirmed that the “scope of the program” program element satisfies the criterion defined in SRP-LR Section A.1.2.3.1 and, therefore, the staff finds it acceptable.

Preventive Actions. LRA Section B.3.40 states that the ASME Code Class 1 Small Bore Piping Inspection Program is an inspection activity independent of methods to mitigate or prevent 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 preventive actions and thus, this information need not be provided.

The staff noted that since the applicant’s program is a condition monitoring program, it does not rely on preventive actions and, therefore, this information need not be provided.

The staff confirmed that the “preventive actions” program element satisfies the criterion defined in SRP-LR Section A.1.2.3.2 and, therefore, the staff finds it acceptable.

Parameters Monitored or Inspected. LRA Section B.3.40 states that the ASME Code Class 1 Small Bore Piping Inspection Program will perform volumetric examination on the subject butt welds. However, the applicant stated that for socket welds, the program will only perform a visual inspection (VT-2) for the subject socket welds.

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 and for a condition monitoring program, the parameter monitored or inspected should detect the presence and extent of aging effects.

The staff noted that for the subject butt welds, the use of volumetric, surface, and visual inspections will be performed on a periodic basis such that degradation, such as cracking and leakage, is monitored and inspected.

The staff also noted that, for the subject socket welds, only VT-2 visual inspections will be performed which is only for leakage detection. Since cracking in socket welds starts mostly from the inside surface, by the time a leak is detected by VT-2, the subject component would have already failed and lost its intended function. This is the reason GALL AMP XI.M.35 recommends volumetric examinations of small bore piping including socket welds. During a teleconference call on December 14, 2009, the staff informed the applicant that it does not consider visual examination adequate for aging management in small bore socket welds as that is not consistent with the GALL Report recommendations.

By letter dated February 22, 2010, the staff issued RAI B.3.40-2 to indicate that the applicant’s program was not consistent with the recommendation of GALL AMP XI.M.35, and requested the applicant to address examination of socket welds in a manner consistent with the GALL report recommendations. By letter dated March 9, 2010, and as supplemented by letter dated April 28, 2010, the applicant provided its response to the staff’s RAI. In its response, the applicant stated that most of the failures in its operating experience review were due to high cycle fatigue, in which a crack propagates so fast that volumetric inspection/examination would not be useful for detection. The staff disagrees with the applicant's statement, however, and notes that various UT examination techniques are available for detection of flaws caused by high cycle fatigue.

The applicant also stated that VT-2 is considered to be a reasonable part of an AMP, and it is the only practical inspection methodology available today, since there is no qualified volumetric inspection method available for socket welds. The staff noted that various UT procedures have been developed to examine socket welds. Although not specifically qualified for sizing, such efforts can nonetheless provide go/no-go results that are useful in detecting flaws. While the staff understands the applicant's statement that there is no industry-wide "qualified" volumetric standard for socket welds, the staff does not agree that in lieu of such a "qualified" standard, VT-2 is sufficient in meeting the intent of the GALL AMP XI.M35. Where the GALL AMP states that the volumetric technique "needs to be qualified," the staff does not interpret it as a PDI (performance demonstration initiatives) qualified procedure but expects that the applicant should provide some demonstrated technique that is capable of detecting the flaws of relevant size and character for socket welds. The volumetric technique, as discussed in the GALL Report, is not intended to preclude applicants from using alternate techniques that may be available, but rather to detect early signs of failure. In its April 28, 2010, response regarding this issue, the applicant indicated that it will perform volumetric inspections only "if an acceptable nuclear industry methodology for performing volumetric examinations of socket weld fittings is developed." Such a statement did not provide the staff assurance that the recommendations of GALL AMP XI.M35 would be followed to manage the aging effects of socket welds at DAEC. This issue was identified as OI 3.0.3.3.3 in the SER with open items..

By letter dated May 28, 2010, the applicant provided a supplemental response to the RAI B.3.40-2. In its response, the applicant stated that "DAEC will perform volumetric examinations of a minimum of ten percent of the ASME Code Class 1 small bore socket welds each inspection interval." In addition, the applicant stated in Commitment No. 45 that it (1) will perform volumetric examination of ten percent of the Class 1 socket welds (every 10-year interval), and (2) may perform destructive examination on an opportunistic basis in lieu of the socket weld volumetric examination. Based on its review, the staff finds the applicant's response to RAI B.3.40-2 and OI 3.0.3.3.3 acceptable because the applicant's commitment to perform periodic inspections every 10-year interval using volumetric examination is consistent with the recommendations of the GALL Report. Therefore, Open item OI 3.0.3.3.3 is resolved.

The staff confirmed that the "parameters monitored or inspected" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.3 and, therefore, the staff finds it acceptable.

Detection of Aging Effects. LRA Section B.3.40 states that the ASME Code Class 1 Small Bore Piping Inspection Program will inspect 5 out of a total population of 56 of the ASME Code Class 1 Small Bore butt welds less than 4 inch NPS using a volumetric examination prior to the period of extended operation. The applicant further stated that each inspection interval during the period of extended operation a minimum of 10 percent of the ASME Code Class 1 Small Bore butt welds less than 4 inch NPS will receive a volumetric examination. Furthermore, all ASME Code Class 1 Small Bore socket welds presently receive a VT-2 visual inspection during system leakage tests each RFO per the requirements of IWB-2500-1, Examination Category B-P. The applicant stated that it will continue to perform these inspections per the ASME Section XI requirements during the period of extended operation. Initially, the applicant also stated that if methodology for performing volumetric examinations of socket weld fittings is developed, the applicant will perform volumetric examination of a minimum of 10 percent of the ASME Code

Class 1 small bore socket welds each inspection interval. The staff did not agree that VT-2 is sufficient in meeting the recommendations of GALL AMP XI.M35 for socket welds, as discussed in OI 3.0.3.3.3 above. OI 3.0.3.3.3 has since been resolved.

The staff reviewed the applicant's "detection of aging effects" program element against the criteria in SRP-LR Section A.1.2.3.4, which states detection of aging effects should occur before there is a loss of the structure and component intended functions. It states that the parameters to be monitored or inspected should be appropriate to ensure that the structure and component intended functions will be adequately maintained for license renewal under all CLB design conditions. It also states that this includes aspects such as method or technique and information that link the parameters to be monitored or inspected to the aging effects being managed. Furthermore, it states when sampling is used to inspect a group of SCs, the basis for the inspection population and sample size, and the samples used, should be biased toward locations most susceptible to the specific aging effect of concern during the period of extended operation. Furthermore, provisions should also be included on expanding the sample size when degradation is detected in the initial sample.

The staff noted that the applicant plans to use volumetric examinations for small bore piping butt welds and that the examination techniques are routinely used in detecting the aging effect of cracking. The staff noted that the applicant has already experienced cracking in its small bore piping, and that since the examinations prior to the period of extended operation will provide additional sampling for detection of aging effects in its small bore piping, the staff finds it acceptable.

The staff noted that the applicant did not provide a technical justification for sampling only 10 percent of butt welds in each inspection interval during the period of extended operation. By letter dated February 22, 2010, the staff issued RAI B.3.40-1 requesting a justification for the sampling criteria and explanation of why such sampling would be adequate. By letter dated March 9, 2010, the applicant clarified that the sample selection was based on its risk-informed inservice inspection (RI-ISI) program. The staff confirmed that the applicant's RI-ISI program was reviewed and approved by the staff in a letter dated July 31, 2007. Since the sample selection criteria were based on its RI-ISI program previously approved by the staff, and the samples locations are selected using a risk-informed approach, the staff found this to be acceptable.

The staff confirmed that the "detection of aging effects" program element satisfies the criterion defined in SRP-LR Section A.1.2.3.4 and, therefore, the staff finds it acceptable.

Monitoring and Trending. LRA Section B.3.40 states that the ASME Code Class 1 Small Bore Piping Inspection Program will perform inspections at a sufficient number of locations to assure an adequate sample. It further states that the number and sample size will be based on susceptibility, inspectability, dose considerations, operating experience, and limiting locations of the total population of the ASME Code Class 1 small-bore piping locations. The applicant stated that since the inspections are performed as part of the ASME Section XI Program, monitoring and trending is performed to meet code requirements.

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. It also states that plant-specific and/or industry-wide operating experience may be considered in evaluating the appropriateness of the technique and frequency. Furthermore, it states that the program element describes “how” the data collected is evaluated and may also include trending for a forward look. It states that the methodology for analyzing the inspection or test results against the acceptance criteria should be described, and trending is a comparison of the current monitoring results with previous monitoring results in order to make predictions for the future.

The staff confirmed that the “monitoring and trending” program element satisfies the criterion defined in SRP-LR Section A.1.2.3.5 and, therefore, the staff finds it acceptable.

Acceptance Criteria. LRA Section B.3.40 states that if flaws or indications exceed the acceptance criteria of ASME Code Section XI, Paragraph IWB-3400, they will be evaluated in accordance with ASME Code Section XI, Paragraph IWB-3131, and additional examinations are performed in accordance with ASME Code Section XI, Paragraph, IWB-2430.

The staff reviewed the applicant’s “acceptance criteria” program element against the criteria in SRP-LR Section A.1.2.3.6, which states that the acceptance criteria of the program and its basis should be described and should include a methodology for analyzing the results against applicable acceptance criteria.

The staff noted that acceptance criteria of the ASME Code Class 1 Small Bore Piping Inspection Program are based on ASME Code Section XI requirements and that the ASME Code methodology will be used to analyze results of any aging effects detected.

The staff confirmed that the “acceptance criteria” program element satisfies the criterion defined in SRP-LR Section A.1.2.3.6 and, therefore, the staff finds it acceptable.

Operating Experience. LRA Section B.3.40 summarizes operating experience related to the ASME Code Class 1 Small Bore Piping Inspection Program. The applicant provided an operating experience review and provided specific examples of its plant-specific operating experience.

The staff reviewed this information against the acceptance criteria in SRP-LR Section A.1.2.3.10, which states the operating experience includes past corrective actions resulting in program enhancements or additional programs and this information should provide objective evidence to support the conclusion that the effects of aging will be adequately managed so that the structure and component intended functions will be maintained during the period of extended operation.

The staff noted that the applicant’s review demonstrated that the effects of aging are effectively managed and it also provided objective evidence indicating that cracking due to SCC and fatigue is being adequately managed. The staff also noted that the operating experience provides objective evidence that the ASME Code Class 1 Small Bore Piping Inspection Program will be effective in assuring that intended functions will be maintained consistent with the CLB for the period of extended operation.

The staff reviewed the operating experience reports and confirms that the plant-specific operating experience did not reveal any degradation not bounded by industry experience. The operating experience provides evidence that the aging effects of SCC fatigue will be adequately managed through the period of extended operation.

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

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

UFSAR Supplement. The staff reviewed this UFSAR supplement description of the program and notes that it conforms to the recommended description for this type of program as described in SRP-LR Table 3.1-2. The staff also notes that the applicant committed (Commitment No. 45) to implement the new ASME Code Class 1 Small Bore Piping Inspection Program prior to entering the period of extended operation for managing aging of applicable components.

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

Conclusion. On the basis of its technical review of the applicant's ASME Code Class 1 Small Bore Piping Inspection, the staff concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.4 QA Program Attributes Integral to Aging Management Programs

Pursuant to 10 CFR 54.21(a)(3), the applicant is required to demonstrate that the effects of aging on SCs subject to an AMR will be adequately managed so that their intended functions will be maintained consistent with the CLB for the period of extended operation. SRP-LR, Branch Technical Position (BTP) RLSB-1, "Aging Management Review – Generic," describes 10 elements of an acceptable AMP. Elements (7), (8), and (9) are associated with the QA activities of "corrective actions," "confirmation process," and "administrative controls." BTP RLSB-1 Table A.1-1, "Elements of an Aging Management Program for License Renewal," provides the following description of these program elements:

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

(8) Confirmation Process – The confirmation process should ensure that preventive actions are adequate and that appropriate corrective actions are completed and effective.

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

BTP IQMB-1, "Quality Assurance for Aging Management Programs," notes that AMP aspects that affect the quality of safety-related SSCs are subject to the QA requirements of 10 CFR Part 50 Appendix B. Additionally, for nonsafety-related SCs subject to an AMR, the applicant may use the existing 10 CFR Part 50 Appendix B QA program to address the elements of "corrective actions," "confirmation process," and "administrative controls." BTP IQMB-1 provides the following guidance on the QA attributes of AMPs:

- Safety-related SCs are subject to 10 CFR Part 50 Appendix B requirements which are adequate to address all quality-related aspects of an AMP consistent with the CLB of the facility for the period of extended operation.

- For nonsafety-related SCs that are subject to an AMR, an applicant has an option to expand the scope of its 10 CFR Part 50 Appendix B program to include these SCs to address "corrective action," "confirmation process," and "administrative control" for aging management during the period of extended operation. In this case, the applicant should document such commitment in the UFSAR supplement, in accordance with 10 CFR 54.21(d).

3.0.4.1 Summary of Technical Information in the Application

In LRA Appendix A, "Duane Arnold UFSAR Supplement," Section 18.1, "Aging Management Programs," and Appendix B, "Aging Management Programs and Activities," Section B.1.3, "Quality Assurance Program and Administrative Controls," 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 DAEC quality assurance program (QAP) 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 QAP regardless of the safety classification of the components. LRA Appendix A, Section 18.1 and Appendix B, Section B.1.3, state that the QAP implements the requirements of 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," and is consistent with the NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants (SRP-LR)," Revision 1.

3.0.4.2 Staff Evaluation

Pursuant to 10 CFR 54.21(a)(3), an applicant is required to demonstrate that the effects of aging on SCs subject to an AMR will be adequately managed so that their intended functions will be maintained consistent with the CLB for the period of extended operation. The SRP-LR, BTP RLSB-1, "Aging Management Review-Generic," describes 10 attributes of an acceptable AMP. Three of these ten attributes are associated with the QA activities of corrective action, confirmation process, and administrative controls. Table A.1-1, "Elements of an Aging Management Program for License Renewal," of 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, which should ensure that preventive actions are adequate and that appropriate corrective actions have been completed and are effective.

- Attribute No. 9 – Administrative Controls, which should provide a formal review and approval process.

The SRP-LR, 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, QAP 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 NRC 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 Branch Technical Position IQMB-1. Based on the NRC staff's evaluation, the descriptions of the AMPs and their associated quality attributes provided in Appendix A, Section 18.1, and Appendix B, Section B.1.3, of the LRA are consistent with the staff's position regarding QA for aging management.

3.0.4.3 Conclusion

On the basis of the staff's evaluation, the descriptions and applicability of the plant-specific AMPs and their associated quality attributes provided in LRA Appendix A, Section 18.1, and Appendix B, Section B.1.3, were determined to be consistent with the staff's position regarding QA for aging management. The staff concludes that the QA attributes (i.e., corrective action, confirmation process, and administrative control) of the applicant's AMPs are consistent with 10 CFR 54.21(a)(3).

3.1 Aging Management of Reactor Vessel, Reactor Vessel Internals, and Reactor Coolant System

This section of the SER documents the staff's review of the applicant's AMR results for the reactor vessel, reactor vessel internals (RVIs), and RCS components and component groups of:

- nuclear boiler
- reactor vessel recirculation system

3.1.1 Summary of Technical Information in the Application

LRA Section 3.1 provides AMR results for the reactor vessel, RVIs, and RCS components and component groups. LRA Table 3.1.1, “Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 Reactor Coolant System,” is a summary comparison of the applicant’s AMRs with those evaluated in the GALL Report for the reactor vessel, RVIs, and RCS components and component groups.

The applicant’s AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant’s review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.1.2 Staff Evaluation

The staff reviewed LRA Section 3.1 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the reactor vessel, 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, as required by 10 CFR 54.21(a)(3).

The staff conducted an onsite audit of AMRs to ensure the applicant’s claim that certain AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff’s evaluations of the AMPs are documented in SER Section 3.0.3. Details of the staff’s audit evaluation are documented in SER Section 3.1.2.1.

During the onsite audit, the staff also selected AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant’s further evaluations were consistent with the SRP-LR Section 3.1.2.2 acceptance criteria. The staff’s audit evaluations are documented in SER Section 3.1.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with or not addressed in the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed were appropriate for the material-environment combinations specified. The staff’s evaluations are documented in SER Section 3.1.2.3.

For SSCs which the applicant claimed were not applicable, or required no aging management, the staff reviewed the AMR line items and the plant’s operating experience to verify the applicant’s claims.

The staff’s review of the reactor vessel, 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 reactor vessel, RVIs, and RCS components is documented in SER Section 3.0.3.

3.1.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.1.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the reactor vessel, RVIs, and RCS components:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program
- Bolting Integrity Program
- BWR CRD Return Line Nozzle Program
- BWR Feedwater Nozzle Program
- BWR Penetrations Program
- BWR SCC Program
- BWR Vessel ID Attachment Welds Program
- BWR Vessel Internals Program
- External Surfaces Monitoring Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Lubricating Oil Analysis Program
- One-Time Inspection Program
- Reactor Head Closure Studs Program
- Reactor Vessel Surveillance Program
- Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel Program
- Water Chemistry Program

LRA Tables 3.1.2-1 and 3.1.2-2 summarize AMRs for the nuclear boiler and reactor vessel recirculation system components and indicate AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency with the report and for which it does not recommend further evaluation, the staff's audit and review determined whether the plant-specific components of these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant noted for each AMR line item how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A through E indicating how the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report and validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report and confirmed that the identified exceptions to the GALL Report AMPs have been reviewed and accepted. The staff also determined whether the applicant's AMP was consistent with the GALL Report AMP and whether the AMR was valid for the site-specific conditions.

Note C indicates that the component for the AMR line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report; however, the applicant identified in the GALL Report a different component with the same material, environment, aging effect, and AMP as the component under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicates that the component for the AMR line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report. The staff confirmed whether the AMR line item of the different component was applicable to the component under review and whether the identified exceptions to the GALL Report AMPs have been reviewed and accepted. The staff also determined whether the applicant's AMP was consistent with the GALL Report AMP and whether the AMR was valid for the site-specific conditions.

Note E indicates that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but credits a different AMP. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the credited AMP would manage the aging effect consistently with the GALL Report AMP and whether the AMR was valid for the site-specific conditions.

The staff audited and reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the reactor vessel, RVIs, and RCS components that are subject to an AMR. On the basis of its audit and review, the staff determines that, for AMRs not requiring further evaluation, as identified in LRA Table 3.1.1, the applicant's references to the GALL Report are acceptable and no further staff review is required, with the exception of the following AMRs that the applicant had identified were consistent with the AMRs of the GALL Report and for which the staff felt were in need of additional clarification and assessment. The staff's evaluations of these AMRs are provided in the subsection that follows.

3.1.2.1.1 AMR Results Identified as Not Applicable

LRA Table 3.1-1, item 3.1.1-57 addresses CASS Class 1 piping, piping components, and piping elements and CRD pressure housings exposed to reactor coolant with a temperature greater than 250 °C (482 °F). The LRA further states that this item is not applicable to the RCS. The staff reviewed LRA Tables 3.1.2-1 and 3.1.2-2 and confirmed that the applicant's plant has no CASS materials exposed to reactor coolant with a temperature greater than 250 °C (482 °F) that should have been addressed under item 3.1.1-57. Therefore, the staff finds that this item is not applicable.

LRA Table 3.1-1, items 3.1.1-13, 3.1.1-20, and 3.1.1-26 address steel and stainless steel isolation condenser components exposed to reactor coolant. The LRA further indicates that the aging issues for these components are not applicable because the DAEC does not have an isolation condenser. The staff reviewed LRA Tables 3.1.2-1 and 3.1.2-2 and confirmed that the applicant's plant has no isolation condenser. Therefore, the staff finds that this item is not applicable.

3.1.2.1.2 Cracking due to Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, Cyclic Loading

LRA Table 3.1.1, item 3.1.1-40 addresses cracking due to SCC, IGSCC, cyclic loading in stainless steel and nickel alloy penetrations for CRD, stub tubes instrumentation, jet pump instrumentation, SLC, flux monitor, and drain line exposed to reactor coolant.

For item 3.1.1.40, the applicant stated that it manages the cracking due to SCC, IGSCC, cyclic loading in stainless steel, nickel alloy and steel clad with nickel alloy nozzles and penetrations in the reactor vessel by the Water Chemistry Program, and the BWR Penetrations Program or BWR Vessel Internals Program, and the drain nozzle by ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The applicant further stated that the AMR items are consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited (note E) for the CRD stub tubes, the thermal sleeve of the CRD, and the nozzle drain.

The staff noted that GALL Report Volume 1, Table 1 ID 40 recommends this aging effect for those components be managed by GALL AMP XI.M8, "BWR Penetrations," and GALL AMP XI.M2, "Water Chemistry," programs. However, the applicant did not provide justification for selecting alternative programs for aging management other than the one recommended by the GALL Report.

Similarly, for the safe-end of CRD, the applicant credited its BWR Penetrations Program to manage the aging effect identified in GALL Report Volume 1, Table 1 ID 41 that recommends GALL AMP XI.M.7, "BWR Stress Corrosion Cracking" to manage this aging effect. The staff noted that the applicant did not provide justification for selecting an alternative program for aging management other than the one recommended by the GALL Report.

The staff noted that GALL AMPs XI.M7 and XI.M8 refer to specific BWRVIP reports that contain guidelines for the inspections of their respective components in the BWRVIP documents for cracking due to SCC/IGSCC. The staff noted that the applicant's alternatives for aging management do not include these specific guidelines from the BWRVIP reports, so it is not clear that the applicant's proposed AMPs will adequately inspect these components.

By letter dated November 13, 2009, the staff issued RAI 3.1.2.1-a requesting the applicant to demonstrate that the AMP proposed will perform inspections and evaluations which are consistent with those recommended in the GALL Report for the following components: CRD stub tubes, nozzle drain, thermal sleeve of the CRD, and safe-end of CRD, for which it assigned a generic note E, or to revise the proposed programs so that they are consistent with the programs recommended by the GALL Report.

In its response dated December 14, 2009, the applicant stated that there is an inconsistency between the penetrations listed in GALL Report Volume 1, Table 1, and the associated description for GALL AMP XI.M8. The applicant explained that the discussion and guidance provided in GALL XI.M8 is limited to only the SLC and instrumentation penetrations and that GALL XI.M8 provides no guidance for the other components listed in GALL Report Volume 1, Table 1, ID 40. The applicant added that, as discussed in its response to RAI B.3.10-7 in letter NG-09-0764, dated October 13, 2009, the DAEC SLC penetration is nozzle N10 and instrumentation penetrations are nozzles N11A/B, N12A/B, and N16A/B and that the BWR Penetrations Program manages these penetrations.

The staff noted that the BWRVIP-27-A report covers the SLC penetrations and the BWRVIP-49-A report covers instrumentation penetrations. GALL AMP XI.M8 states that it monitors the effects of SCC/IGSCC on the intended function of the component by detection and sizing of cracks by ISI in accordance with the guidelines of approved BWRVIP-49 or BWRVIP-27.

Based on its review, the staff finds the applicant’s response to RAIs B.3.10-7 and 3.1.2.1-a for the SLC and instrumentation penetrations acceptable because the applicant’s program is consistent with the GALL Report recommendations and industry guidelines.

The applicant further stated in its response to RAI B.3.10-7 that revisions were made to LRA Table 3.1.2-1 to correct the AMP that is credited for the jet pump instrumentation nozzle and safe-end, CRD safe-end, and core differential pressure and SLC safe-end.

In its response to RAI B.3.10-7 dated October 13, 2009, the applicant stated that the LRA indicates that some nozzles are incorrectly managed by the BWR Penetrations Program. The applicant stated that the jet pump instrumentation nozzles (N8A and N8B) and the reactor vessel drain nozzle (N15) are being managed by the BWR Penetrations Program, but explained this is incorrect, as they are actually managed by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. Similarly, the applicant stated that the CRD safe-ends are shown as being managed by the BWR Penetrations Program, but are actually being managed by the BWR CRD Return Line Nozzle Program. Based on the applicant’s responses to RAIs B.3.10-7 and 3.1.2.1-a, the applicant revised its LRA to cite the correct programs for components in LRA Table 3.1.2-1, as they relate to LRA Table 3.1-1, item 3.1.1-40, or the BWR Penetrations Program, as follows:

- Line item 3.1.1-40 in LRA Table 3.1-1 will include the jet pump instrument nozzle in addition to the drain nozzle for being managed by ASME Code Section XI Inservice Inspection, Subsection IWB, IWC, and IWD Program.

- Line item for the core differential pressure and SLC safe-end for the aging effect requiring management of cracking in LRA Table 3.1.2-1 will be managed by BWR Penetrations and Water Chemistry programs (note C). For this component, the applicant also modified its selection of GALL AMR item from 3.1.1-20 to 3.1.1-40.

- Line item for the jet pump instrumentation nozzle and safe-end for the aging effect requiring management of cracking in LRA Table 3.1.2-1 will be managed by ASME Code Section XI and Water Chemistry programs (note C). For this component, the applicant also modified its selection of GALL AMR item from 3.1.1-20 to 3.1.1-40.

- Line item for the CRD safe-end for the aging effect requiring management of cracking in LRA Table 3.1.2-11 will be managed by BWR CRD Return Line Nozzle Program (note C). For this component, the applicant also modified its selection of GALL AMR item from 3.1.1-38 to 3.1.1-41.

Concerning the revision the applicant proposed for the core differential pressure and SLC safe-end, the staff finds the applicant's use of the BWR Penetrations Program and the Water Chemistry Program, instead of the BWR Stress Corrosion Cracking Program, for managing the aging effect of cracking due to SCC/IGSCC and cyclic loading for this component acceptable because it is consistent with the recommendation of the GALL Report.

GALL AMP XI.M8 states that this program monitors the effects of SCC/IGSCC on the intended function of the component by detection and sizing of cracks by ISI in accordance with the guidelines of approved BWRVIP-49 or BWRVIP-27. BWRVIP-27-A guidelines address the internals, the housings or nozzles attached to the vessel, the safe-ends welded to the nozzles, and the safe-end extensions welded to the housings for BWR SLC system/core plate ΔP penetration. Since BWRVIP-27-A includes the core differential pressure and SLC safe-end, the applicant's selection of the BWR Penetrations Program is consistent with the recommendations of the GALL Report.

Based on its review, the staff finds the applicant's response to RAIs B.3.10-7 and 3.1.2.1-a for the core differential pressure and SLC safe-end acceptable because the applicant's program is consistent with the GALL Report recommendations and industry guidelines.

Concerning the jet pump instrumentation nozzle and safe-end, the staff noted that it is not clear why the applicant credited another program than the one recommended by the GALL Report. For these components, instead of GALL Report Volume 1, Table 1 ID 40 and GALL AMR item IV.A1-5, which recommends the BWR Penetrations Program, the applicant credited GALL Report Volume 1, Table 1 ID 40 and GALL AMR item IV.C1-4 dedicated to the isolation condenser components. However, even if the combination of the material (stainless steel), the environment (reactor coolant), and the aging effect (cracking) is appropriate, the staff noted that the applicant stated in LRA Table 3.1.1-20 that this item is not applicable to the applicant because it does not have an isolation condenser. The staff held conference calls on December 14, 2009, and January 8, 2010, with the applicant to discuss this issue. By letter dated January 14, 2010, the applicant revised its references to GALL AMR item 3.1.1-20 for the jet pump instrumentation nozzle and safe-end back to 3.1.1-40. In conjunction with this modification, the notes for these line items were also revised from C (component is different, but consistent with GALL item for material, environment, and aging effect. AMP is consistent with GALL AMP) to E (consistent with GALL item for material, environment, and aging effect, but a different AMP is credited, or a plant-specific AMP). The applicant further stated that it would credit the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program in addition to the Water Chemistry Program. The staff noted that these penetrations are situated below the top of active fuel (TAF), which is used as a reference for defining the location of instrumentations taken into account in BWRVIP-49-A, which is referenced by GALL AMP XI.M8. The staff noted that the guidelines of this BWRVIP report do not directly apply to jet pump instrumentation nozzle and safe-end, and consequently GALL AMP XI.M8 does not address these two components. Therefore, only examinations in accordance with the requirements of ASME Code Section XI are performed on jet pump instrumentation nozzle and safe-end. The applicant also appropriately credited the Water Chemistry Program in order to completely address the aging mechanism of SCC/IGSCC.

Based on its review, the staff finds the applicant's response to RAIs B.3.10-7 and 3.1.2.1-a for the jet pump instrumentation nozzle and safe-end acceptable because the applicant's use of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD and Water Chemistry programs is adequate to address the aging effect of cracking due to SCC/IGSCC and cyclic loading for these components.

Concerning the CRD safe-end, the staff noted that it is not clear which aging mechanisms the applicant credited for this component since it chose only GALL AMR item IV.A1-2 and removed GALL AMR item IV.A1-1. The staff noted that this means that the applicant would manage the aging mechanism of cracking with the BWR CRD Return Line Nozzle Program only, instead of the BWR Stress Corrosion Cracking and Water Chemistry programs as recommended by the GALL Report. The staff noted that cracking induced by cyclic loading can be managed by the BWR CRD Return Line Nozzle associated to GALL AMR item IV.A1-2, but does not understand how the applicant will manage cracking due to SCC and IGSCC of GALL AMR item IV.A1-1, because it is not clear whether the applicant will use the Water Chemistry Program. The staff held a conference call with the applicant on January 8, 2010, to discuss this issue. By letter dated January 14, 2010, the applicant stated that the line item for safe-end – CRD in LRA Table 3.1.2-1 is revised to appear with the GALL AMR item IV.A1-1, the BWR CRD Return Line Nozzle Program and note E (consistent with GALL item for material, environment, and aging effect, but a different AMP is credited, or a plant-specific AMP). However, the staff noted that the applicant did not explain which cracking mechanism is applicable to the CRD safe-end (mechanical fatigue, stress corrosion induced, or both), therefore, it is still not clear whether the applicant needs to also credit the mitigating Water Chemistry Program to manage the aging effect of cracking due to SCC/IGSCC, in addition to inservice inspections included in the BWR CRD Return Line Nozzle Program.

The staff held a conference call with the applicant on February 2, 2010, discussing whether the Water Chemistry Program was credited. By letter dated March 9, 2010, the applicant confirmed that the safe-end welds were examined using UT and did not rely on surface examination. The applicant also referred to its response to RAI B.3.8-2 for the BWR CRD Return Line Nozzle Program. In its response to RAI B.3.8-2, the applicant stated that, as currently implemented, the CRD return line piping containing stagnant water is required to be ultrasonically examined. Moreover, in LRA Section B.3.8.1, the applicant stated that it performs periodic ultrasonic inspections of critical regions of the CRD return line nozzle. The applicant further stated that it inspects the CRD return line stainless steel pipe section welds that contains stagnant water and is susceptible to IGSCC, and that the section of pipe that is susceptible to IGSCC runs from the nozzle safe-end to a reducer.

The staff reviewed the applicant's BWR CRD Return Line Nozzle Program and its evaluation is documented in SER Section 3.0.3.1.8. The staff determined that this program performs volumetric examinations for the CRD safe-end with a frequency compatible with the BWR Stress Corrosion Cracking Program and is capable of detecting this cracking due to SCC/IGSCC.

The applicant also stated that it credits the Water Chemistry Program in LRA Table 3.1.2-1 for the line item related to the CRD safe-end.

Based on its review, the staff finds the applicant's response to RAIs B.3.10-7 and 3.1.2.1-a for CRD safe-end acceptable because the applicant's choice of the BWR CRD Return Line Nozzle and Water Chemistry programs is adequate to address all aspects of the aging effect of cracking due to SCC/IGSCC for this component.

In its response to RAI 3.1.2.1-a dated December 14, 2009, the applicant further stated that with the LRA changes made in its response to RAI B.3.10-7, there are three components, which refer to item 3.1.1-40, that use note E: the drain nozzle, CRD stub tube, and CRD thermal sleeve.

The applicant further stated that CRD stub tubes and thermal sleeves are managed with the BWR Vessel Internals Program, rather than the BWR Penetrations Program. The applicant explained that the BWR Penetrations Program uses the guidance of BWRVIP-27-A and BWRVIP-49-A and these reports do not encompass the CRD stub tubes and thermal sleeves. The inspection and flaw evaluation guidelines applicable to vessel lower plenum components, which include the CRD housing and stub tubes, are given in BWRVIP-47-A. The staff noted that BWRVIP-47-A is included within the scope of the BWR Vessel Internals Program. The applicant stated that the BWR Vessel Internals Program will, therefore, adequately manage aging of the CRD stub tubes and thermal sleeves.

The applicant further stated that the drain nozzle is managed with the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program, rather than the BWR Penetrations Program. The staff noted that the BWR Penetrations Program uses the guidance of BWRVIP-27-A and BWRVIP-49-A, which do not include the drain nozzle in their scope. The ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program incorporates the inspection requirements of ASME Code, Section XI, in accordance with 10 CFR 50.55a, and will adequately manage aging of the drain nozzle.

The staff finds that GALL AMP XI.M8 uses the guidelines of staff-approved BWRVIP-49 and BWRVIP-27 documents. The BWRVIP-49-A report specifies that it concerns the water level instrument penetrations located in the upper vessel, with the lowest locations just above the TAF, as shown in the figure 2.1 – Location of Water Level Instrument Penetrations.

The BWR Vessel Internals Program includes inservice inspections consistent with the material/environment/aging mechanism combination for the CRD stub tubes and thermal sleeves. Therefore, the staff considers that the applicant's proposition to manage the CRD stub tubes and thermal sleeves with the BWR Vessel Internals Program, rather than the BWR Penetrations Program, combined with the Water Chemistry Program appropriate because of the location of these components.

Based on its review, the staff finds the applicant's response to RAIs B.3.10-7 and 3.1.2.1-a for the CRD stub tube and CRD thermal sleeve acceptable because the applicant's choice of the BWR Vessel Internals and Water Chemistry programs is adequate to address all aspects of the aging mechanism of cracking due to SCC/IGSCC for these components.

Likewise, the staff noted that according to the location of this component and the material/environment/aging mechanism combination, the aging effect of cracking due to SCC/IGSCC for the drain nozzle can be adequately managed by the ASME Section XI

Inservice Inspection, Subsections IWB, IWC, and IWD Program, rather than the BWR Penetrations Program, and the Water Chemistry Program. The staff determined that the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program are capable of detecting cracking due to SCC/IGSCC. The staff reviewed the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program and its evaluation is documented in SER Section 3.0.3.1.3.

Based on its review, the staff finds the applicant's response to RAIs B.3.10-7 and 3.1.2.1-a for the drain nozzle acceptable because the applicant's choice of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program and the Water Chemistry Program is adequate to address all aspects of the aging mechanism of cracking due to SCC/IGSCC for this component.

Based on its review, the staff found that the applicant adequately addressed all the issues in RAIs B.3.10-7 and 3.1.2.1-a. The staff's concern described in RAIs B.3.10-7 and 3.1.2.1-a are resolved.

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).

3.1.2.1.3 Cracking Due to Stress Corrosion Cracking, Loss of Material Due to Wear, Loss of Preload Due to Thermal Effects, Gasket Creep, and Self-Loosening

LRA Table 3.1-1, item 3.1.1-52 addresses cracking due to SCC, loss of material due to wear, and loss of preload due to thermal effects, gasket creep, and self-loosening for steel and stainless steel RCPB pump and valve closure bolting, manway and holding bolting, flange bolting, and closure bolting in high-pressure and high-temperature ASME Class 1 systems. For this component, material, environment, and aging effect combination, the applicant stated that its AMR results are consistent with the GALL Report and that it uses the Bolting Integrity Program to manage the aging effects of cracking, loss of material, and loss of preload in the components associated with LRA Table 3.1-1, item 3.1.1-52.

The staff reviewed the applicant's AMR results associated with LRA Table 3.1-1, item 3.1.1-52. The staff noted that the applicant did not show any AMR results in the RCS (LRA Table 3.1.2-1, "Nuclear Boiler," and LRA Table 3.1.2-2, "Reactor Vessel Recirculation System") to be associated with LRA Table 3.1-1, item 3.1.1-52. The staff also noted that the applicant indicated all AMR results for fasteners, bolting, washers, and nuts in the RCS (LRA Tables 3.1.2-1 and 3.1.2-2) are associated with LRA Table 3.2-1 (ESFs), items 3.2.1-23 or 3.2.1-24, or the applicant cited note F for the AMR result indicating that the material is not in the GALL Report for the stated component. The staff further noted that the only AMR results associated with LRA Table 3.1-1, item 3.1.1-52 was one AMR result line in LRA Table 3.3.2-30 (page 3.3-250) for fastener, bolting, washers, nuts made of carbon steel in the SLC system, with an environment of "system temperature up to 288 °C (550 °F) (internal)" and with the aging effect of loss of preload managed by the Bolting Integrity Program.

By letter dated November 13, 2009, the staff issued RAI Table Item 3.3.1-52-01 requesting the applicant explain why the AMR results for bolting and fasteners in the RCS were referenced to LRA Table 3.2-1, items 3.2.1-23 and -24, and why there was no reference to LRA Table 3.1-1, item 3.1.1-52. The staff also asked the applicant to explain why the AMR result for bolting and fasteners in the SLC system was referenced to LRA Table 3.1-1, rather than to LRA Table 3.3-1, item 3.3.1-45, which appears to be more appropriate for bolting in the SLC system.

In its response dated December 14, 2009, the applicant stated that in LRA Tables 3.1.2-1 and 3.1.2-2 document the results are for ASME Class 1 components and that the environment listed in the LRA for the fastener [“air indoor-uncontrolled (external)”] was incorrect. The applicant revised the LRA to show the bolting and fasteners with an external environment of “system temperature up to 288 °C (550 °F)” and aligned these AMR results with LRA Table 3.1.1, item 3.1.1-52.

As revised by the applicant, LRA Tables 3.1.2-1 and 3.1.2-2 each show four lines for fasteners, bolting, washers, nuts made of carbon steel or stainless steel. In each LRA table three of the revised lines are associated with GALL Report Volume 2, items IV.C1-10 (R-27), IV.C1-12 (R-26), or IV.C1-13 (R-29). For these AMR results, the applicant stated that for carbon steel or stainless steel bolting the aging effect of loss of material will be managed by the Bolting Integrity Program and that for carbon steel bolting the aging effect of loss of preload will also be managed by the Bolting Integrity Program. For these AMR results the applicant cited note A, indicating that the results are consistent with recommendations in the GALL Report. In addition, for the fourth revised AMR result line in each revised LRA table, the applicant stated that for stainless steel bolting the aging effect of loss of preload is managed by the Bolting Integrity Program; however, the applicant cited note H, indicating that the aging effect is not identified for this component, material, and environment combination in the GALL Report. In addition, the applicant stated that the SLC system, addressed in LRA Table 3.3.2-30, contains both Class 1 and non-Class 1 bolting components and that LRA Table 3.3.2-30 shows the Class 1 fasteners, bolting, washers, nuts aligned to LRA Table 3.1.1, item 3.1.1-52 and shows the non-Class 1 fasteners, bolting, washers, nuts aligned to LRA Table 3.3.1, items 43 and 45.

The staff reviewed the applicant’s LRA changes and compared them with corresponding AMR result lines in the GALL Report. For those revised AMR result lines where the applicant cited note A, indicating consistency with the GALL Report, the staff determined that the revised results are consistent with recommendations in the GALL Report for these component, material, and environment combinations. On the basis that the applicant’s revised AMR results are consistent with recommendations in the GALL Report, the staff finds the applicant’s changes where note A was cited to be acceptable.

The staff reviewed the applicant’s explanation with regard to AMR results for bolting and fasteners in the SLC system. The staff finds the applicant’s explanation to be satisfactory because Class 1 bolting components in the SLC system are appropriately aligned with results for Class 1 bolting components in the GALL Report, and the aging effects and AMPs are consistent with the GALL Report’s recommendations for these components. The staff’s concern described in RAI Table Item 3.3.1-52-01, is resolved.

The staff’s evaluation of AMR results where the applicant cited note H is presented in SER Section 3.1.2.3.1 for AMR results not consistent with or not addressed in the GALL Report. As discussed further in Section 3.1.2.3.1, the staff also found that the applicant’s changes where note H is cited to be acceptable.

Based on its review, the staff finds the applicant’s response to RAI Table Item 3.3.1-52-01 acceptable because the applicant made the necessary revisions to its AMR results, as described above, such that they were either consistent with the recommendations of the GALL

Report or the staff evaluated these AMR results in SER Section 3.1.2.3.1 The staff's concern described in RAI Table Item 3.3.1-52-01, is resolved.

Based on the LRA changes incorporated by the applicant's response to RAI Table Item 3.3.1-52-01, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.1.2, the applicant further evaluates the effects of aging management, as recommended by the GALL Report, for the reactor vessel, 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
- loss of fracture toughness due to neutron irradiation embrittlement and void swelling
- cracking due to SCC
- cracking due to cyclic loading
- loss of preload due to stress relaxation
- loss of material due to erosion
- cracking due to flow-induced vibration
- cracking due to SCC and IASCC
- cracking due to primary water SCC
- wall thinning due to flow-accelerated corrosion
- changes in dimensions due to void swelling
- cracking due to SCC and primary water SCC
- cracking due to SCC, primary water SCC, and IASCC

- QA for aging management of nonsafety-related components

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which the report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.1.2.2.The staff's review of the applicant's further evaluation follows.

3.1.2.2.1 Cumulative Fatigue Damage

In LRA Section 3.1.2.2.1, the applicant stated that fatigue is considered a TLAA as defined in 10 CFR 54.3 for the RPV and components of the RCPB, and TLAAs are evaluated in LRA Section 4.3 in accordance with 10 CFR 54.21(c)(1). In LRA Table 3.1.1, the applicant identified AMR items 3.1.1-1 through 3.1.1-5 as TLAA items for the RCS. The applicant performed cumulative fatigue evaluations for these components. The applicant stated that no plant-specific fatigue analysis was conducted for the RVI because there is no CLB to support the RVI components to be a TLAA.

The applicant stated in LRA Table 3.1.1 that AMR items 3.1.1-6 through 3.1.1-12 are applicable to pressurized water reactors (PWRs) only. The staff reviewed these AMR items in the SRP-LR and in the GALL Report and finds these items do not apply to the applicant because DAEC is a BWR plant. SER section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

LRA Section 4.3.2 states that no fatigue analysis of the entire RVIs was performed because its RVIs are not Class 1 pressure boundary components, except for the shroud support, which is considered part of the vessel. The staff noted that, even though being non-pressure boundary components, Class 1 components are subject to fatigue requirements. For older vintage plants, there may be cases where an explicit fatigue usage evaluation is not required, but RVIs may be implicitly designed for low-cycle fatigue based upon the RCS design transient projections for 40 years. By letter dated September 14, 2009, the staff issued RAI 4.3.2-1 requesting that the applicant justify why fatigue requirements are not addressed for the RVI components except for the shroud support.

In its response dated October 13, 2009, the applicant stated the criteria for a TLAA is defined in 10 CFR 54.3. The staff noted that all six criteria, as defined in 10 CFR 54.3, must be met in order to be classified as a TLAA. Specifically, the staff noted that 10 CFR 54.3(a)(6) states that TLAAs are those applicant's calculations and analyses that "are contained or incorporated by reference in the CLB." The applicant stated that, during its review of its CLB, it did not identify a fatigue evaluation that was performed for the RPV internals. The applicant further stated that, as indicated in LRA Section 4.3.2, the shroud support is considered part of the RPV and was, therefore, evaluated for fatigue and is considered a TLAA. The staff confirmed that shroud support was evaluated in LRA Section 4.3.1.

Based on its review, the staff finds the applicant's response to RAI 4.3.2-1 acceptable because the applicant reviewed its CLB and verified that there are no calculations and analyses that meet the definition of a TLAA, as defined in 10 CFR 54.3(a) and specifically there are no calculations and analyses that are contained or incorporated by reference in its CLB. The staff's concern described in RAI 4.3.2-1 is resolved. SER Section 4.3 documents the staff's review of the applicant's evaluation of TLAA for these components.

3.1.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.1.2.2.2 against the following criteria in SRP-LR Section 3.1.2.2.2:

(1) LRA Section 3.1.2.2.2.1 addresses the RPV and RCPB steel components exposed to treated water (reactor coolant). The LRA states that these components are managed for loss of material due to general, crevice, and pitting corrosion by the Water Chemistry Program and 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 this program, including susceptible locations, such as areas of stagnant flow.

The staff reviewed LRA Section 3.1.2.2.2.1 against the criteria in SRP-LR Section 3.1.2.2.2.1, which states that: (1) loss of material due to general, pitting, and crevice corrosion could occur for the steel top head enclosure (without cladding) top head nozzles (vent, top head spray or RCIC, and spare) exposed to reactor coolant, (2) the existing program relies on control of reactor water chemistry to mitigate corrosion, and (3) control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations of stagnant flow conditions; therefore, the effectiveness of the Chemistry Control Program should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to verify the effectiveness of the Water Chemistry Control Program. A one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is occurring or is slowly progressing such that the components intended functions will be maintained during the period of extended operation.

The staff reviewed the applicant’s Water Chemistry Program and One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.1.26 and 3.0.3.1.21, respectively. The staff found that these programs: (1) provide for periodic sampling of treated water to maintain contaminants at acceptable limits to preclude loss of material due to general, pitting, and crevice corrosion, and (2) will perform one-time inspections of steel top head enclosure (without cladding) top head nozzles (vent, top head spray or RCIC, and spare) exposed to reactor coolant for loss of material due to general, pitting, and crevice corrosion to verify the effectiveness of the Water Chemistry Program. The GALL Report states that a one-time inspection is an acceptable method to verify the effectiveness of a mitigative AMP, such as the Water Chemistry Program. The staff noted that the applicant is crediting the Water Chemistry Program and the applicant is verifying effectiveness of water chemistry program with the elements of the One-Time Inspection Program, which the GALL Report states is an acceptable program to verify the Water Chemistry Program’s effectiveness. Therefore, the staff finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.1.2.2.2.1.

Based on the programs identified, the staff concludes that the applicant’s programs meet SRP-LR Section 3.1.2.2.2.1 criteria. For those line items that apply to LRA Section 3.1.2.2.2.1, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) LRA Section 3.1.2.2.2.2 addresses the applicant's evaluation for LRA Table 3.1.1, item 3.1.1-13. In the LRA, the applicant stated that this item in the GALL Report pertains to BWR isolation condenser components and that the applicant does not have an isolation condenser. The applicant further stated that the RPV and RCPB steel and stainless steel piping components exposed to treated water (reactor coolant) are managed for loss of material due to general, crevice, and pitting corrosion by the Water Chemistry Program. The applicant also stated 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 this program, including susceptible locations, such as areas of stagnant flow.

The staff reviewed LRA Section 3.1.2.2.2.2 against the criteria in SRP-LR Section 3.1.2.2.2.2, which states that loss of material due to pitting and crevice corrosion could occur in stainless steel BWR isolation condenser components exposed to reactor coolant and that loss of material due to general, pitting, and crevice corrosion could occur in steel BWR isolation condenser components. The SRP-LR states that the existing program relies on control of reactor water chemistry to mitigate corrosion and that effectiveness of the chemistry control program should be verified to ensure that corrosion does not occur. The SRP-LR states that a one-time inspection of selected components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

SRP-LR Section 3.1.2.2.2.2 invokes AMR item 13 in Table 1 of the GALL Report, Volume 1, and GALL AMR item IV.C1-6 (R-16), applicable for stainless steel and steel BWR isolation condenser components in a reactor coolant environment. The GALL Report recommends that for these components, the Water Chemistry Program in combination with the One-Time Inspection Program be used to manage the aging effect of loss of material due to general (steel only), pitting, and crevice corrosion.

The staff noted that although the applicant's plant does not have an isolation condenser, the applicant has associated a number of AMR line items with LRA Table 3.1.1, item 3.1.1-13 (e.g., the line item for carbon steel Class 1 valves exposed to reactor coolant (internal) in the core spray system shown in LRA Table 3.2.2-1, page 3.2-27). For these AMR line items, the applicant cited note C, indicating that the component is different, but consistent with the GALL Report for material, environment, and aging effect; and the AMP is consistent with what is recommended in the GALL Report. The staff noted that these AMR line items show the same material, environment, and aging effect results that are recommended in the GALL Report for the isolation condenser (item IV.C1-6 (R-16)) and that the GALL Report does not recommend appropriate AMR result lines for other carbon steel Class 1 components exposed to reactor coolant. The staff also noted that the applicant credits the same AMPs that are recommended in the GALL Report for management of loss of material due to general, pitting, and crevice corrosion in steel isolation condenser components exposed to reactor coolant. On the basis that the material, environment, aging effect, and AMPs are all consistent with an AMR result in the GALL Report (item IV.C1-6 (R-16)), the staff finds the applicant's AMR results associated with LRA Table 3.1.1, item 3.1.1-13 to be acceptable.

The staff reviewed the applicant's Water Chemistry Program and One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.1.26 and 3.0.3.1.21, respectively. The staff found that these programs: (1) provide for periodic sampling of treated water to maintain contaminants at acceptable limits to preclude loss of material due to general, pitting, and crevice corrosion, and (2) will perform one-time inspections of RCPB steel and stainless steel piping and components exposed to treated water (reactor coolant) for loss of material due to general, pitting, and crevice corrosion to verify the effectiveness of the Water Chemistry Program. The GALL Report states that a one-time inspection is an acceptable method to verify the effectiveness of a mitigative AMP such as the Water Chemistry Program. The staff noted that the applicant is crediting the Water Chemistry Program as recommended in the GALL Report and the applicant is verifying the effectiveness of the Water Chemistry Program with the elements of the One-Time Inspection Program, which the GALL Report states is an acceptable program to verify the Water Chemistry Program's effectiveness. Therefore, the staff finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.1.2.2.2.2

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.2.2 criteria. For those line items that apply to LRA Section 3.1.2.2.2.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(3) LRA Section 3.1.2.2.2.3 addresses RPV and RCPB stainless steel, nickel alloy, and steel with stainless steel or nickel clad piping and components exposed to treated water (reactor coolant). The LRA states that these components are managed for loss of material due to crevice and pitting corrosion by the Water Chemistry Program and the effectiveness of the Water Chemistry Program will be confirmed by the One-Time Inspection Program or the BWR Vessel Internals 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 3.1.2.2.2.3 against the criteria in SRP-LR Section 3.1.2.2.2.3, which states that: (1) loss of material due to pitting and crevice corrosion could 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; (2) the existing program relies on control of reactor water chemistry to mitigate corrosion; and (3) control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations of stagnant flow conditions; therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to verify the effectiveness of the chemistry control program. A one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is progressing very slowly such that the components intended function will be maintained during the period of extended operation.

The staff reviewed the applicant's Water Chemistry Program and One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.1.26 and 3.0.3.1.21, respectively. The staff found that these programs: (1) provide for periodic sampling of reactor water to maintain contaminants at acceptable limits to preclude loss of material due to pitting and crevice corrosion, and (2) will perform one-time inspections of select steel and 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 for loss of material due to pitting and crevice corrosion to verify the effectiveness of the Water Chemistry Program. The GALL Report states that a one-time inspection is an acceptable method to verify the effectiveness of a mitigative AMP such as the Water Chemistry Program. The staff noted that the applicant is crediting the Water Chemistry Program as recommended in the GALL Report and the applicant is verifying the effectiveness of the Water Chemistry Program with the elements of the One-Time Inspection Program, which the GALL Report states is an acceptable program to verify the Water Chemistry Program's effectiveness. Therefore, the staff finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.1.2.2.2.3.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.2.3 criteria. For those line items that apply to LRA Section 3.1.2.2.2.3, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(4) LRA Section 3.1.2.2.2.4 addresses loss of material due to general, pitting, and crevice corrosion in PWR steam generator upper and lower shell and transition cone exposed to secondary feedwater and steam. The applicant stated that this aging effect is not applicable because DAEC is a BWR.

SRP-LR Section 3.1.2.2.2.4 states that loss of material due to general, pitting, and crevicecorrosion may occur in the steel PWR steam generator upper and lower shell and transition cone exposed to secondary feedwater and steam. The staff confirmed that SRP-LR Table 3.1-1, item 16 is only applicable to PWR plants.

On the basis of its review, the staff concluded that because DAEC is a BWR, SRP-LR Section 3.1.2.2.2.4 is not applicable to DAEC.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.2 criteria and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.3 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement

LRA Section 3.1.2.2.3 states that neutron irradiation embrittlement is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1).

In LRA Section 3.1.2.2.3, the applicant stated that the loss of fracture toughness due to neutron irradiation embrittlement in reactor vessel beltline shell, nozzle, and welds is managed by the Reactor Vessel Surveillance Program. The applicant also stated that reduction in fracture toughness due to radiation embrittlement could occur for reactor vessel beltline region that are exposed to a neutron fluence value greater than 1 x 10^{17} (E is greater than 1 MeV).

The staff reviewed LRA Section 3.1.2.2.3 and its evaluation is as follows:

SRP-LR Section 3.1.2.2.3 states that loss of fracture toughness due to neutron irradiation embrittlement may occur in BWR and PWR reactor vessel beltline shell, nozzle, and welds exposed to reactor coolant and neutron flux. The Reactor Vessel Surveillance Program monitors neutron irradiation embrittlement of the reactor vessel. Reactor vessel surveillance programs are plant-specific, depending on matters such as the composition of limiting materials, availability of surveillance capsules, and projected fluence levels. In accordance with 10 CFR Part 50, Appendix H, an applicant is required to submit its proposed withdrawal schedule for approval prior to implementation. Untested capsules placed in storage must be maintained for future insertion. Thus, further staff evaluation is required for license renewal. Specific recommendations for an acceptable AMP are provided in GALL Report Chapter XI, Section M31. The ISP, and elements of the program, and the results of its evaluation for license renewal, are presented in LRA Appendix B.3.35.

(1) LRA Section 3.1.2.2.3.1 provides the applicant's discussion that neutron irradiation embrittlement is a TLAA. The applicant stated that, "Certain aspects of neutron irradiation embrittlement are time-limited aging analyses (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 evaluation of this TLAA is documented separately in SER Section 4.2.

(2) LRA Section 3.1.2.2.3.2 provides the applicant's discussion on 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 NRC approved the two BWRVIP reports in an SE dated February 1, 2002. BWRVIP-116 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. The staff's acceptance of the Reactor Vessel Surveillance Program is documented in SER Section 3.0.3.2.10.

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, as required by 10 CFR 54.21(a)(3).

3.1.2.2.4 Cracking Due to Stress Corrosion Cracking and Intergranular Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.4 against the criteria in SRP-LR Section 3.1.2.2.4:

(1) The applicant stated in LRA Section 3.1.2.2.4.1 that cracking due to SCC and IGSCC in the stainless steel and nickel alloy BWR top head enclosure vessel flange leak detection lines does not apply, because the reactor vessel flange leak-off line is made of carbon steel and no program is, therefore, required to manage SCC or IGSCC.

The staff reviewed LRA Section 3.1.2.2.4.1 against the criteria in SRP-LR Section 3.1.2.2.4.1, which states that: (1) cracking due to SCC and IGSCC could occur in the stainless steel and nickel alloy BWR top head enclosure vessel flange leak detection lines and (2) 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 noted that, in LRA Table 3.1.2-1, the applicant credits the One-Time Inspection Program and the Water Chemistry Program to manage cracking of the nickel alloy leakage detection line which is exposed to reactor coolant. LRA Table 3.1.2-1 points to LRA Table 3.1.1, item 19, where a plant-specific program is credited for management of cracking.

The GALL Report recommends in item IV.A1-10 (R-61) for the applicant to develop a plant-specific program to manage cracking of nickel alloy in reactor coolant. The staff noted that a one-time inspection is used for verification that an aging effect does not occur or is occurring at such a slow rate that it will not cause the loss of intended function during the period of extended operation. The staff does not consider cracking of nickel alloy in reactor water unlikely. Additionally, the staff noted that the applicant's One-Time Inspection Program does not specify the method to be used to detect cracking.

By letter dated November 13, 2009, the staff issued RAI 3.1.2.2.4-1 requesting that the applicant provide consistency between LRA Section 3.1.2.2.4, LRA Table 3.1.2-1, and LRA Table 3.1.1, item 19, on the correct material for the leak line and, if it is nickel alloy, provide the plant-specific program additional information demonstrating that cracking of nickel alloy in reactor water is unlikely or occurring very slowly such that one-time inspection is appropriate if the plant-specific program is based on one-time inspection.

In its responses dated December 14, 2009, the applicant stated that the reactor vessel flange leak detection line is constructed from ASTM A-106 Grade B carbon steel material; however, at the point the leak detection line is attached to the reactor vessel carbon steel head flange, a short coupling or nozzle is installed which is made from SB-166 nickel alloy. The applicant stated that it conservatively assigned reactor coolant as the internal environment for these components, because the instrument line is drained in conjunction with reactor vessel reassembly during RFOs and a separate, spare flange leak detection line has a capped connection and is assumed to remain filled with reactor coolant. The applicant further stated that, while the nickel-alloy couplings are appropriately addressed in LRA Table 3.1.2-1, the discussions in LRA Section 3.1.2.2.4 and Table 3.1-1, item 3.1.1-19, do not acknowledge the nickel-alloy material. These discussions are revised below to indicate that, while the reactor vessel flange leak detection line is carbon steel and not susceptible to SCC, the line attachment nozzle at the reactor vessel flange is nickel alloy and is susceptible to SCC.

The applicant also stated that the One-Time Inspection Program is credited to verify the effectiveness of the Water Chemistry Program because the nozzles involved are only pressurized if the inboard reactor vessel head seal fails, and there is no operating experience suggesting this has ever occurred. The applicant also made LRA changes to correct and clarify the materials and the environment for the flange leak detection lines.

Based on its review, the staff finds the applicant's response to RAI 3.1.2.2.4-1 acceptable because SCC or IGSCC is not likely for the nickel alloy reactor vessel attachment nozzles since these nozzles are not usually exposed to reactor coolant and are not normally pressurized. The applicant is managing SCC and IGSCC in these nozzles with its Water Chemistry Program, and the One-Time Inspection Program will provide verification of effectiveness of the Water Chemistry Program. The staff's concern described in RAI 3.1.2.2.4-1 is resolved.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.1.2.2.4.1 criteria. For those line items that apply to LRA Section 3.1.2.2.4.1, 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).

(2) LRA Section 3.1.2.2.4.2 addresses cracking due to SCC and IGSCC in isolation condenser components. The applicant stated that this aging effect is not applicable because DAEC design does not include an isolation condenser.

The staff reviewed and verified that DAEC does not include isolation condensers.

Based on its review, the staff concludes that the recommendations in SRP-LR Section 3.1.2.2.4.2 are not applicable because DAEC designs do not include isolation condenser systems.

3.1.2.2.5 Crack Growth Due to Cyclic Loading

LRA Section 3.1.2.2.5 addresses crack growth due to cyclic loading. The applicant stated that this aging effect is not applicable because DAEC is a BWR.

The staff reviewed LRA Section 3.1.2.2.5 against the criteria in SRP-LR Section 3.1.2.2.5, which states that crack growth due to cyclic loading can occur in the reactor vessel shell forgings clad with stainless steel using a high-heat-input welding process.

The staff confirmed that SRP-LR Table 3.1-1, item 21 is only applicable to PWR plants.

On the basis of its review, the staff concluded that because DAEC is a BWR, SRP-LR Section 3.1.2.2.5 is not applicable to DAEC.

3.1.2.2.6 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement and Void Swelling

The staff reviewed LRA Section 3.1.2.2.6 against the criteria in SRP-LR Section 3.1.2.2.6.

LRA Section 3.1.2.2.6 addresses loss of fracture toughness due to neutron irradiation embrittlement and void swelling. The applicant stated that this aging effect is not applicable because DAEC is a BWR.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.6 criteria is not applicable.

3.1.2.2.7 Cracking Due to Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.7 against the following criteria in SRP-LR Section 3.1.2.2.7:

(1) LRA Section 3.1.2.2.7.1 addresses cracking due to SCC in PWR stainless steel reactor vessel flange leak detection lines and bottom-mounted instrument guide tubes exposed

to reactor coolant. The applicant stated that this aging effect is not applicable because it is a BWR.

The staff reviewed SRP-LR Section 3.1.2.2.7.1 and confirmed that the SRP-LR does state that cracking due to SCC may occur in the PWR stainless steel reactor vessel flange leak detection lines and bottom-mounted instrument guide tubes exposed to reactor coolant.

The staff reviewed the UFSAR Chapter 1 and confirmed that the applicant has a reactor that is a GE Model 4 BWRs with Mark I primary containment design. The staff also confirmed that SRP-LR Table 3.1-1, item 23 is only applicable to PWR plants. Based on its review, the staff concludes that the recommendations in SRP-LR Section 3.1.2.2.7.1 are not applicable to the applicant, a BWR plant.

(2) LRA Section 3.1.2.2.7.2 states that cracking due to SCC in Class 1 PWR CASS reactor coolant system piping, piping components, and piping elements exposed to reactor coolant is not applicable because this is only applicable to PWRs.

The staff reviewed LRA Section 3.1.2.2.7.2 against the criteria in SRP-LR Section 3.1.2.2.7.2, which states that: (1) cracking due to SCC could occur in Class 1 PWR CASS reactor coolant system piping, piping components, and piping elements exposed to reactor coolant, (2) the existing program relies on the control of water chemistry to mitigate SCC; however SCC could occur for CASS components that do not meet the NUREG-0313 guidelines with regard to ferrite and carbon content, and (3) the GALL Report recommends further evaluation of a plant-specific program for these components to ensure that this aging effect is adequately managed.

The staff noted that in LRA Table 3.4.2-4, the applicant credits the One-Time Inspection Program and the Water Chemistry Program to manage cracking of CASS Class 1 flow elements that are exposed to reactor coolant. LRA Table 3.4.2-4 points to LRA Table 3.1.1, item 41, where the BWR Stress Corrosion Cracking and Water Chemistry programs are credited for the management of cracking.

The GALL Report recommends in item IV.C1-9 (R-20), GALL AMP XI.M7, “BWR Stress Corrosion Cracking,” and GALL AMP XI.M2, “Water Chemistry,” to manage cracking of CASS components in a reactor coolant environment. The staff noted that a one-time inspection is used for verification that an aging effect does not occur or is occurring at such a slow rate that it will not cause the loss of intended function during the period of extended operation. The staff does not consider cracking of CASS in reactor water unlikely.

By letter dated November 13, 2009, the staff issued RAI 3.1.2.2.7-1 requesting that the applicant provide additional information demonstrating that cracking of CASS in reactor coolant is unlikely or occurring very slowly such that a one-time inspection is appropriate.

In its response dated December 14, 2009, the applicant stated that the main steam line flow elements are fabricated from CASS material and are welded inside carbon steel pipe, are not a pressure boundary, and are not subject to tensile stress that would promote SCC; therefore, SCC is not a potential aging effect for these components. As a result of its evaluation, the applicant revised the LRA to remove the management cracking of the CASS Class 1 flow element.

The staff noted that weld residual stresses could initiate cracks which could propagate due to cyclic loading or flow induced vibration. Therefore, the staff does not agree that cracking of the CASS Class 1 flow element is an aging effect that does not require management and finds that the applicant's response to RAI 3.1.2.2.7-1 is unacceptable. By letter dated March 9, 2010, the applicant amended its response to RAI 3.1.2.2.7-1 to state that the main steam flow restrictors align better with GALL line items in GALL Report Chapter VIII, "Steam and Power Conversion System," rather than GALL Report Chapter IV, "Reactor Vessel, Internals, and Reactor Coolant System" and, therefore, the applicant amended the LRA to cite LRA Table 3.4.1, item 3.4.1-13 and GALL AMR item VIII.B2-1, "Flow Element Class 1," to manage cracking of main steam flow restrictors. The staff noted that GALL AMR item VIII.B2-1 addresses cracking/SCC of stainless steel piping, piping components, and piping elements exposed to steam and agrees with the applicant that this line item is more appropriate than item IV.C1-9 (R-20). The staff also noted that the GALL Report recommends GALL AMP XI.M2, "Water Chemistry," and GALL AMP XI.32, "One-Time Inspection," to manage SCC, and the applicant has amended its LRA to manage SCC of main steam flow orifices using the applicant's One-Time Inspection Program and the Water Chemistry Program.

Based on its review, the staff finds the applicant's response to RAI 3.1.2.2.7-1, as amended by letter dated March 9, 2010, acceptable because the applicant amended its LRA so that the main steam flow restrictors reference GALL AMR item VIII.B2-1 and the applicant will manage cracking due to SCC with its Water Chemistry Program and One-Time Inspection Program. The staff's concern described in RAI 3.1.2.2.7-1 is resolved.

The staff noted that this SRP-LR Section 3.1.2.2.7.2 is no longer applicable because the applicant amended its LRA to reference LRA Table 3.4.1, item 3.4.1-13. The staffs review of these main steam flow restrictors are documented in SER Section 3.4.2.2.6.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.7 critieria is not applicable.

3.1.2.2.8 Cracking Due to Cyclic Loading

The staff reviewed LRA Section 3.1.2.2.8 against the criteria in SRP-LR Section 3.1.2.2.8:

(1) LRA Section 3.1.2.2.8.1 addresses cracking due to cyclic loading in stainless steel BWR jet pump sensing lines. The applicant stated that the jet pump sensing lines inside the reactor vessel do not form part of the RCPB and their failure would not affect the performance of any functions in the scope of license renewal. The applicant further stated that these lines have no license renewal component intended function and thus are not subject to an AMR. However, the applicant stated that these jet pump sensing lines outside the vessel are part of the RCPB and hence are subject to an AMR.

The staff reviewed LRA Section 3.1.2.2.8.1 against the criteria in SRP-LR Section 3.1.2.2.8.1, which states that cracking due to cyclic loading could 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 reactor vessel 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 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 reactor vessel 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 reactor vessel are not subject to an AMR to be acceptable.

The staff noted that for the jet pump instrumentation nozzle and jet pump instrumentation safe-end outside of the reactor vessel that are subject to an AMR, the applicant referenced LRA Table 3.1.1, items 3.1.1-14 and 3.1.1-40. The staff further noted that LRA Table 3.1.1, item 3.1.1-14 addresses loss of material due to pitting and crevice corrosion and item 3.1.1-40 addresses cracking due to SCC, IGSCC and cyclic loading. The GALL Report recommends the use of the Water Chemistry Program and One-Time Inspection Program for item 3.1.1-14 and the use of the BWR Penetrations Program and Water Chemistry Program for item 3.1.1-40. The staff confirmed that for the carbon steel with stainless steel cladding jet pump instrumentation nozzle and stainless steel jet pump instrumentation safe-end the applicant: (1) credits its Water Chemistry Program and One-Time Inspection Program to manage loss of material due to pitting and crevice corrosion and (2) credits its BWR Penetrations Program and Water Chemistry Program to manage cracking due to SCC, IGSCC, and cyclic loading, and finds it acceptable because it is consistent with the recommendations of the GALL Report.

Based on its review, the staff concludes that the recommendation in SRP-LR Section 3.1.2.2.8.1 is not applicable because: (1) the applicant's jet pump sensing lines inside the reactor vessel are not within the scope of license renewal and (2) for the jet pump sensing lines outside the vessel that are within the scope of license renewal, the applicant is managing the effects of aging consistent with the recommendations of the GALL Report.

(2) LRA Section 3.1.2.2.8.2 addresses cracking due to cyclic loading in isolation condenser components. The applicant stated that this aging effect is not applicable because DAEC design does not include an isolation condenser.

The staff reviewed LRA Section 3.1.2.2.8.2 against the criteria in SRP-LR Section 3.1.2.2.8.2, which states that cracking due to cyclic loading could occur in steel and stainless steel BWR isolation condenser components exposed to reactor coolant. The existing program relies on ASME Section XI ISI. However, the existing program should be augmented to detect cracking due to cyclic loading. The GALL Report recommends an augmented program to include temperature and radioactivity monitoring of the shell-side water, and eddy current testing of tubes to ensure that the component's intended function will be maintained during the period of extended operation.

The staff reviewed the applicant's UFSAR and noted that Chapter 5.4 of the UFSAR states that the applicant uses its RCIC system that provides core cooling during reactor isolation by pumping makeup water into the reactor vessel to prevent low water level. The staff reviewed the applicant's UFSAR and verified that the applicant's plant design does not include isolation condensers.

> Based on its review, the staff concludes that the recommendation in SRP-LR Section 3.1.2.2.8.2 is not applicable because the applicant's plant design does not include isolation condenser systems.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.8 criteria is not applicable.

3.1.2.2.9 Loss of Preload Due to Stress Relaxation

The staff reviewed LRA Section 3.1.2.2.9 against the criteria in SRP-LR Section 3.1.2.2.9.

LRA Section 3.1.2.2.9 addresses loss of preload due to stress relaxation. The applicant stated that this aging effect is not applicable because DAEC is a BWR plant.

SRP-LR Section 3.1.2.2.9 states that loss of preload due to stress relaxation may occur in stainless steel and nickel alloy PWR RVIs screws, bolts, tie rods, and hold-down springs exposed to reactor coolant.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.9 criteria is not applicable.

3.1.2.2.10 Loss of Material Due to Erosion

The staff reviewed LRA Section 3.1.2.2.10 against the criteria in SRP-LR Section 3.1.2.2.10.

LRA Section 3.1.2.2.10 addresses loss of material due to erosion in steam generators. The applicant stated that this aging effect is not applicable because DAEC is a BWR plant.

SRP-LR Section 3.1.2.2.10 states that loss of material due to erosion may occur in steel steam generator feedwater impingement plates and supports exposed to secondary feedwater. Because DAEC is a BWR, the staff finds that this item in SRP-LR Section 3.1.2.2.10 does not apply to DAEC.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.10 criteria is not applicable.

3.1.2.2.11 Cracking Due to Flow-Induced Vibration

The staff reviewed LRA Section 3.1.2.2.11 against the criteria in SRP-LR Section 3.1.2.2.11.

LRA Section 3.1.2.2.11 addresses cracking due to flow-induced vibration. The applicant stated that cracking due to flow-induced vibration for DAEC stainless steel steam dryers exposed to reactor coolant is managed by a combination of the BWR Vessel Internals Program and the BWR Water Chemistry Program.

SRP-LR Section 3.1.2.2.11 states that cracking due to flow-induced vibration could occur for the BWR stainless steel steam dryers exposed to reactor coolant. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed.

The flow induced vibration associated with fluctuating pressure loading on the steam dryers due to increased flow at extended power uprate (EPU) conditions have caused high cycle fatigue cracking in some plants. In addition, high cycle fatigue cracking could manifest very quickly. However, the operating history at Duane Arnold indicates that the steam dryer has been operating successfully since 2001, maintaining structural integrity of the dryer at EPU conditions. The operating history at EPU, coupled with the licensee's commitment to following the BWRVIP-139 guidelines, provides reasonable assurance for steam dryer integrity for the period of extended operation

Table 2-1 of BWRVIP-139 indicates that a comprehensive steam dryer inspection was performed at DAEC during RFO18 in 2003 based on plant surveys. For the period of extended operation, the previously performed BWRVIP-139 steam dryer inspections established a baseline for the inspections. The applicant indicated in the LRA that it will comply with the BWRVIP recommendations for steam dryer inspections.

The staff determined that BWRVIP-139 provides an adequate method of managing cracking in the steam dryers during the period of extended operation. In addition, the staff determined that performing the inspections in accordance with BWRVIP-139 provides assurance that the steam dryer will perform its intended function during the period of extended operation. The use of baseline inspections to compare future inspection results will provide a means of determining whether any new cracking is occurring and if any further action is needed. The staff concludes that this approach is 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, as required by 10 CFR 54.21(a)(3).

3.1.2.2.12 Cracking Due to Stress Corrosion Cracking and Irradiation-Assisted Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.12 against the criteria in SRP-LR Section 3.1.2.2.12.

LRA Section 3.1.2.2.12 addresses cracking due to SCC and IASCC. The applicant stated that this aging effect is not applicable because DAEC is a BWR plant.

SRP-LR Section 3.1.2.2.12 states that cracking due to SCC and IASCC may occur in PWR stainless steel reactor internals exposed to reactor coolant.

The staff confirmed in SRP-LR Table 3.1-1, item 30 is only applicable to PWR plants.

Because DAEC is a BWR, the staff finds that this item in SRP-LR Section 3.1.2.2.12 does not apply to DAEC.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.12 critieria is not applicable.

3.1.2.2.13 Cracking Due to Primary Water Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.13 against the criteria in SRP-LR Section 3.1.2.2.13.

LRA Section 3.1.2.2.13 addresses cracking due to primary water stress corrosion cracking (PWSCC). The applicant stated that this aging effect is not applicable because DAEC is a BWR plant.

SRP-LR Section 3.1.2.2.13 states that cracking due to PWSCC may occur in PWR components made of nickel alloy and steel with nickel alloy cladding, including RCPB components and penetrations inside the RCS, such as pressurizer heater sheathes and sleeves, nozzles, and other internal components.

The staff confirmed in SRP-LR Table 3.1-1, item 31 is only applicable to PWR plants.

Because DAEC is a BWR, the staff finds that this item in SRP-LR Section 3.1.2.2.13 does not apply to DAEC.

3.1.2.2.14 Wall Thinning Due to Flow-Accelerated Corrosion

The staff reviewed LRA Section 3.1.2.2.14 against the criteria in SRP-LR Section 3.1.2.2.14.

LRA Section 3.1.2.2.14 addresses wall thinning due to flow-accelerated corrosion in steam generators. The applicant stated that this aging effect is not applicable because DAEC is a BWR plant.

SRP-LR Section 3.1.2.2.14 states that wall thinning due to flow-accelerated corrosion may occur in steel feedwater inlet rings and supports. The staff concludes that the recommendations in SRP-LR 3.1.2.2.14 are not applicable because DAEC is not a PWR designed reactor.

The staff confirmed in SRP-LR Table 3.1-1, item 32 is only applicable to PWR plants.

Because DAEC is a BWR, the staff finds that this item in SRP-LR Section 3.1.2.2.14 does not apply to DAEC.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.14 criteria is not applicable.

3.1.2.2.15 Changes in Dimensions Due to Void Swelling

The staff reviewed LRA Section 3.1.2.2.15 against the criteria in SRP-LR Section 3.1.2.2.15.

LRA Section 3.1.2.2.15 addresses changes in dimensions due to void swelling. The applicant stated that this aging effect is not applicable because DAEC is a BWR plant.

SRP-LR Section 3.1.2.2.15 states that changes in dimensions due to void swelling may occur in stainless steel and nickel alloy PWR internal components exposed to reactor coolant.

The staff confirmed in SRP-LR Table 3.1-1, item 33 is only applicable to PWR plants.

Because DAEC is a BWR, the staff finds that this item in SRP-LR Section 3.1.2.2.15 does not apply to DAEC.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.15 criteria is not applicable.

3.1.2.2.16 Cracking Due to Stress Corrosion Cracking and Primary Water Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.16 against the following criteria in SRP-LR Section 3.1.2.2.16:

(1) LRA Section 3.1.2.2.16 addresses cracking due to SCC and PWSCC on the primary coolant side of PWR steel steam generator upper and lower heads, tubesheets, and tube-to-tube sheet welds made or clad with stainless steel. The applicant stated that this aging effect is not applicable because DAEC is a BWR.

SRP-LR Section 3.1.2.2.16 states that cracking due to SCC may occur on the primary coolant side of PWR steel steam generator upper and lower heads, tubesheets, and tube-to-tube sheet welds made or clad with stainless steel. Cracking due to PWSCC may occur on the primary coolant side of PWR steel steam generator upper and lower heads, tubesheets, and tube-to-tube sheet welds made or clad with nickel alloy.

The staff concludes that the recommendations in SRP-LR 3.1.2.2.16.1 are not applicable because DAEC is not a PWR designed reactor.

(2) LRA Section 3.1.2.2.16.2 addresses cracking due to SCC and PWSCC on stainless steel pressurizer spray heads and nickel alloy pressurizer heads, respectively. The applicant stated that this aging effect is not applicable because DAEC is a BWR.

SRP-LR Section 3.1.2.2.16.2 states that cracking due to SCC may occur on stainless steel pressurizer spray heads. Cracking due to PWSCC may occur on nickel-alloy pressurizer spray heads.

The staff concludes that the recommendations in SRP-LR 3.1.2.2.16.2 are not applicable because DAEC is not a PWR designed reactor.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.16 criteria is not applicable.

3.1.2.2.17 Cracking Due to Stress Corrosion Cracking, Primary Water Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.17 against the criteria in SRP-LR Section 3.1.2.2.17.

LRA Section 3.1.2.2.17 addresses cracking due to SCC, PWSCC, and IASCC. The applicant stated that this aging effect is not applicable because DAEC is a BWR plant.

SRP-LR Section 3.1.2.2.17 states that cracking due to SCC, PWSCC, and IASCC may occur in PWR stainless steel and nickel alloy RVI components.

The staff concludes that the recommendations in SRP-LR 3.1.2.2.17 are not applicable because DAEC is not a PWR designed reactor.

Based on the above, the staff concludes that SRP-LR Section 3.1.2.2.17 criteria is not applicable.

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 and 3.1.2-2, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

In LRA Tables 3.1.2-1 and 3.1.2-2, the applicant indicated, via notes F through J, that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 Stainless Steel Fasteners, Bolting, Washers, and Nuts Exposed to System Temperature Up to 288 °C (550 °F) (External)

The staff reviewed LRA Table 3.1.2-1, which summarizes the results of AMR evaluations for the nuclear boiler component groups.

As revised by the applicant's response to RAI Table item 3.3.1-52-01, which is discussed in SER Section 3.1.2.1.3, LRA Tables 3.1.2-1 and 3.1.2-2 state that stainless steel fasteners, bolting, washers, and nuts exposed to system temperature up to 288 °C (550 °F) (external) have an aging effect of loss of preload and that the aging effect is managed by the Bolting Integrity Program. For these AMR result lines, the applicant cited note H, indicating that the aging effect is not identified for this component, material, and environment combination in the GALL Report.

The staff evaluated the applicant's use of note H for this component, material, and environment combination and found that, although the GALL Report includes this component, material, and environment combination in item IV.C1-13 (R-29), it does not list loss of preload as an aging effect requiring management for this component, material, and environment combination. On this basis, the staff finds the applicant's use of note H to be acceptable.

The staff noted that reduction of bolting and fastener preload may be caused by mechanisms such as thermal effects (differential expansion of fasteners and housings), gasket creep, and self-loosening, and that these mechanisms are applicable for both carbon steel and stainless steel bolting and fasteners. The staff further noted that the GALL Report (item IV.C1-10 (R-27)) recommends using the Bolting Integrity Program to manage loss of preload in carbon steel (low alloy) bolting exposed to system temperature up to 288 °C (550 °F). The staff also noted that activities in the Bolting Integrity Program that manage loss of preload are equally effective for carbon steel and stainless steel bolts. On the basis that the applicant's use of note H is appropriate and the applicant manages the aging effect with the same program that is recommended in the GALL Report for this component and environment, but a different metal alloy subject to the same aging mechanisms, the staff finds the applicant's aging management results to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations 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).

3.1.2.3.2 Low Alloy Steel exposed to Air-Indoor Uncontrolled Susceptible to Cracking

In LRA Table 3.1.2-1, the applicant stated that the low alloy steel reactor pressure vessel shell stabilizer welds exposed to air-indoor uncontrolled (external) are being managed for cracking by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The AMR line items cite generic note H, indicating that for this line item, the aging effect is not in the GALL Report for this component, material, and environment combination.

The staff's review of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program and its evaluation is documented in SER Section 3.0.3.1.3. The staff finds the applicant's currently proposed AMP acceptable because it will perform either a surface or volumetric inspection in accordance with ASME Code Section XI for these stabilizer welds. The staff confirmed that these stabilizer welds are included within the scope of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The staff noted that a surface or volumetric inspection is capable of detecting the aging effect of cracking in low alloy steel welds exposed to an air-indoor controlled environment.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3.3 Nickel Alloy exposed to Reactor Coolant Susceptible to Cracking

In LRA Table 3.1.2-1, the applicant stated that the nickel alloy feedwater thermal sleeve exposed to reactor coolant (external) is being managed for cracking by the BWR Feedwater Nozzle Program. The AMR line items cite generic note F, indicating that for this line item, the material is not in the GALL Report for this component.

The staff noted that the applicant has identified that loss of material is an aging effect requiring management, and has credited its Water Chemistry Program and BWR Feedwater Nozzle Program for aging management, consistent with the recommendations in the GALL Report. The staff also noted that the applicant has appropriately identified cracking as another aging effect requiring management because temperature fluctuations in feedwater nozzle and the thermal sleeve may result in thermal cycling and cracking.

The staff's review of the BWR Feedwater Nozzle Program and its evaluation is documented in SER Section 3.0.3.1.9. The staff finds the applicant's currently proposed AMP acceptable because it will perform ultrasonic examinations in accordance with ASME Code Section XI Table IWB-2500-1 for the feedwater nozzle and thermal sleeve, which is consistent with the recommendations of GALL AMP XI.M5. The staff confirmed that these stabilizer welds are included within the scope of the ASME Code Section XI Table IWB-2500-1 and in its BWR Feedwater Nozzle Program. The staff noted that an ultrasonic inspection is capable of detecting the aging effect of cracking in the nickel alloy thermal sleeve exposed to reactor coolant environment.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3.4 Low Alloy Steel exposed to Air with Reactor Coolant Leakage Susceptible to Loss of Material

In LRA Table 3.1.2-1, the applicant stated that the low alloy steel top head enclosure studs and nuts exposed to air with reactor coolant leakage (external) is being managed for loss of material by the Reactor Head Closure Studs Program. The AMR line items cite generic note H, indicating that for this line item, the aging effect is not in the GALL Report for this component, material, and environment combination.

The staff also noted that the applicant has appropriately identified loss of material due to wear as an aging effect requiring management because wear may occur from removal and installation of the reactor closure head.

The staff's review of the Reactor Head Closure Studs Program and its evaluation is documented in SER Section 3.0.3.1.23. The staff finds the applicant's currently proposed AMP acceptable because it will perform ultrasonic examinations or surface examinations in accordance with ASME Code Section XI Table IWB-2500-1 for the top head closure studs and nuts, which is consistent with GALL AMP XI.M3. The staff confirmed that the closure studs and nuts are included within the scope of the ASME Code Section XI Table IWB-2500-1 and in its Reactor Head Closure Studs Program. The staff noted that volumetric or surface examinations are capable of detecting the aging effect of loss of material in the low alloy steel closure studs and nuts exposed to air with reactor coolant leakage environment.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the reactor vessel, reactor vessel internals, and reactor coolant system components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2 Aging Management of Engineered Safety Features

This section of the SER documents the staff's review of the applicant's AMR results for the ESFs components and component groups of:

- core spray system
- high pressure coolant injection (HPCI) system
- primary containment
- reactor core isolation cooling (RCIC) system
- residual heat removal system
- standby gas treatment system (SGTS)

3.2.1 Summary of Technical Information in the Application

LRA Section 3.2 provides AMR results for the ESFs components and component groups. LRA Table 3.2.1, "Summary of Aging Management Evaluations in Chapter V of NUREG-1801 Engineered Safety Features," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the ESFs components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.2.2 Staff Evaluation

The staff reviewed LRA Section 3.2 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the ESFs components within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted an onsite audit of 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.

During the onsite audit, the staff also selected AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the SRP-LR Section 3.2.2.2 acceptance criteria. The staff's audit evaluations are documented in SER Section 3.2.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with or not addressed in the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed were appropriate for the material-environment combinations specified. The staff's evaluations are documented in SER Section 3.2.2.3.

For SSCs which the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR line items and the plant's operating experience to verify the applicant's claims.

The staff's review of the ESFs 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 ESFs components is documented in SER Section 3.0.3.

3.2.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the ESFs components:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program
- Bolting Integrity Program
- Buried Piping and Tanks Inspection Program
- BWR SCC Program
- External Surfaces Monitoring Program
- Fire Water System Program
- Flow-Accelerated Corrosion Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Lubricating Oil Analysis Program
- One-Time Inspection Program
- Open-Cycle Cooling Water Program
- Selective Leaching of Materials Program
- Water Chemistry Program

LRA Tables 3.2.2-1 through 3.2.2-6 summarize AMRs for the ESFs components and indicate AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency with the report and for which it does not recommend further evaluation, the staff's audit and review determined whether the plant-specific components of these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant noted for each AMR line item how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A through E indicating how the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report and validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report and verified that the identified exceptions to the GALL Report AMPs have been reviewed and accepted. The staff also determined whether the applicant's AMP was consistent with the GALL Report AMP and whether the AMR was valid for the site-specific conditions.

Note C indicates that the component for the AMR line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report; however, the applicant identified in the GALL Report a different component with the same material, environment, aging effect, and AMP as the component under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicates that the component for the AMR line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report. The staff confirmed whether the AMR line item of the different component was applicable to the component under review and whether the identified exceptions to the GALL Report AMPs have been reviewed and accepted. The staff also determined whether the applicant's AMP was consistent with the GALL Report AMP and whether the AMR was valid for the site-specific conditions.

Note E indicates that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but credits a different AMP. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the credited AMP would manage the aging effect consistently with the GALL Report AMP and whether the AMR was valid for the site-specific conditions.

The staff audited and reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the ESFs components that are subject to an AMR. On the basis of its audit and review, the staff determines that, for AMRs not requiring further evaluation, as identified in LRA Table 3.2.1, the applicant's references to the GALL Report are acceptable and no further staff review is required, with the exception of the following AMRs that the applicant had identified were consistent with the AMRs of the GALL Report and for which the staff felt were in need of additional clarification and assessment. The staff's evaluations of these AMRs are provided in the subsection that follows.

3.2.2.1.1 AMR Results Identified as Not Applicable

LRA Table 3.2-1, line item 3.2.1-20 addresses CASS piping, piping components, and piping elements exposed to treated water (borated or unborated) greater than 250 °C (greater than 482 °F). The GALL Report recommends the use of GALL AMP XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)," to manage loss of fracture toughness due to thermal aging embrittlement for this component group. The applicant stated that this line item is not applicable because the ESF systems have no CASS components with temperatures greater than 482 °F at DAEC. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the ESF systems that include CASS piping, piping components, and piping elements exposed to treated water (borated or unborated) greater than 250 °C (greater than 482 °F). The staff also noted that a search of the applicant's UFSAR and technical specifications did not find any evidence of CASS piping, piping components, and piping elements exposed to treated water (borated or unborated) greater than 250 °C (greater than 482 °F). Based on its review of the LRA, UFSAR, and technical specifications, the staff confirmed that there are no in-scope CASS piping, piping components, and piping elements exposed to treated water (borated or unborated) greater than 250 °C (greater than 482 °F) in the ESF systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2-1, line item 3.2.1-21 addresses high-strength steel closure bolting exposed to air with steam or water leakage. The GALL Report recommends the use of GALL AMP XI.M18, "Bolting Integrity," to manage cracking due to cyclic loading and SCC for this component group. The applicant stated that this line item is not applicable because the ESF systems have no high-strength steel closure bolting exposed to air with steam or water leakage at DAEC. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the ESF system that include high-strength steel closure bolting exposed to air with steam or water leakage. The staff also noted that a search of the applicant's UFSAR and technical specifications, in addition to an onsite audit interview which included discussion on the extent of high-strength steel closure bolting used, did not find any evidence of high-strength steel closure bolting in the ESF systems exposed to air with steam or water leakage. Based on its review of the LRA, UFSAR, technical specifications, and applicant audit interviews, the staff confirmed that there are no in-scope high-strength steel closure bolting exposed to air with steam or water leakage in the ESF systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2-1, line item 3.2.1-25 addresses stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water greater than 60 °C (greater than 140 °F). The GALL Report recommends the use of GALL AMP XI.M21, "Closed-Cycle Cooling Water System," to manage cracking due to SCC for this component group. The applicant stated that this line item is not applicable because the ESF systems have no stainless steel components exposed to closed-cycle cooling water at DAEC. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the ESF systems that include stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water. The staff also noted that a search of the applicant's UFSAR and technical specifications did not find any evidence of stainless steel piping, piping components, and piping elements in the ESF systems exposed to closed-cycle cooling water greater than 60 °C (greater than 140 °F). Based on its review of the LRA, UFSAR, and technical specifications, the staff confirmed that there are no in-scope stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water greater than 60 °C (greater than 140 °F) in the ESF systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2-1, line item 3.2.1-26 addresses steel piping, piping components, and piping elements exposed to closed-cycle cooling water. The GALL Report recommends the use of GALL AMP XI.M21, "Closed-Cycle Cooling Water System," to manage loss of material due to general, pitting, and crevice corrosion for this component group. The applicant stated that this line item is not applicable because the ESF systems have no steel components exposed to closed-cycle cooling water at DAEC. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the ESF systems that include steel piping, piping components, and piping elements exposed to closed-cycle cooling water. The staff also noted that a search of the applicant's UFSAR and technical specifications did not find any evidence of steel piping, piping components, and piping elements in the ESF systems exposed to closed-cycle cooling water. Based on its review of the LRA, UFSAR, and technical specifications, the staff confirmed that there are no in-scope steel piping, piping components, and piping elements exposed to closed-cycle cooling water in the ESF systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2-1, line item 3.2.1-27 addresses steel heat exchanger components exposed to closed-cycle cooling water. The GALL Report recommends the use of GALL AMP XI.M21, "Closed-Cycle Cooling Water System," to manage loss of material due to general, pitting, and galvanic corrosion for this component group. The applicant stated that this line item is not applicable because the ESF systems have no steel heat exchanger components exposed to closed-cycle cooling water at DAEC. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the ESF systems that include steel heat exchanger components exposed to closed-cycle cooling water. The staff also noted that a search of the applicant's UFSAR and technical specifications did not find any evidence of steel heat exchanger components in the ESF systems exposed to closed-cycle cooling water. Based on its review of the LRA, UFSAR, and technical specifications, the staff confirmed that there are no in-scope steel heat exchanger components exposed to closed-cycle cooling water in the ESF systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2-1, line item 3.2.1-28 addresses stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water. The GALL Report recommends the use of GALL AMP XI.M21, "Closed-Cycle Cooling Water System," to manage loss of material due to pitting and crevice corrosion for this component group. The applicant stated that this line item is not applicable because the ESF systems have no stainless steel components exposed to closed-cycle cooling water at DAEC. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the ESF systems that include stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water. The staff also noted that a search of the applicant's UFSAR and technical specifications did not find any evidence of stainless steel piping, piping components, piping elements, and heat exchanger components in the ESF systems exposed to closed-cycle cooling water. Based on its review of the LRA, UFSAR, and technical specifications, the staff confirmed that there are no in-scope stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water in the ESF systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2-1, line item 3.2.1-29 addresses copper alloy piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water. The GALL Report recommends the use of GALL AMP XI.M21, "Closed-Cycle Cooling Water System," to manage loss of material due to pitting, crevice, and galvanic corrosion for this component group. The applicant stated that this line item is not applicable because the ESF systems have no copper alloy components exposed to closed-cycle cooling water at DAEC. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the ESF systems that include copper alloy piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water. The staff also noted that a search of the applicant's UFSAR and technical specifications did not find any evidence of copper alloy piping, piping components, piping elements, and heat exchanger components in the ESF systems exposed to closed-cycle cooling water. Based on its review of the LRA, UFSAR, and technical specifications, the staff confirmed that there are no in-scope copper alloy piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water in the ESF systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2-1, line item 3.2.1-30 addresses stainless steel and copper alloy heat exchanger tubes exposed to closed-cycle cooling water. The GALL Report recommends the use of GALL AMP XI.M21, "Closed-Cycle Cooling Water System," to manage reduction of heat transfer due to fouling for this component group. The applicant stated that this line item is not applicable because the ESF systems have no stainless steel of copper alloy components exposed to closed-cycle cooling water at DAEC. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the ESF systems that include stainless steel and copper alloy heat exchanger tubes exposed to closed-cycle cooling water. The staff also noted that a search of the applicant's UFSAR and technical specifications did not find any evidence of stainless steel and copper alloy heat exchanger tubes in the ESF systems exposed to closed-cycle cooling water. Based on its review of the LRA, UFSAR, and technical specifications, the staff confirmed that there are no in-scope stainless steel and copper alloy heat exchanger tubes exposed to closed-cycle cooling water in the ESF systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2-1, line item 3.2.1-33 addresses steel encapsulation components exposed to an air-indoor uncontrolled (internal) environment. The GALL Report recommends the use of GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," to manage loss of material due to general, pitting, and crevice corrosion for this component group. The applicant stated that this line item is not applicable because the ESF systems have no steel encapsulation components exposed to internal air at DAEC. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the ESF systems that include steel encapsulation components exposed to an air-indoor uncontrolled (internal) environment. The staff also noted that a search of the applicant's UFSAR and technical specifications did not find any evidence of steel encapsulation components in the ESF systems exposed to an air-indoor uncontrolled (internal) environment.

Based on its review of the LRA, UFSAR, and technical specifications, the staff confirmed that there are no in-scope steel encapsulation components exposed to an air-indoor uncontrolled (internal) environment in the ESF systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2-1, line item 3.2.1-38 addresses stainless steel containment isolation piping and components internal surfaces exposed to raw water. The GALL Report recommends the use of GALL AMP XI.M20, "Open-Cycle Cooling Water System," to manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion, and fouling for this component group. The applicant stated that this line item is not applicable because the ESF systems have no stainless steel containment isolation piping and components exposed to raw water at DAEC. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the ESF system that include stainless steel containment isolation piping and components internal surfaces exposed to raw water. The staff also noted that a search of the applicant's UFSAR and technical specifications did not find any evidence of stainless steel containment isolation piping and components internal surfaces in the ESF systems exposed to raw water. Based on its review of the LRA, UFSAR, and technical specifications, the staff confirmed that there are no in-scope stainless steel containment isolation piping and components internal surfaces exposed to raw water in the ESF systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2-1, line item 3.2.1-41 addresses copper alloy greater than 15 percent Zn piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water. The GALL Report recommends the use of GALL AMP XI.M33, "Selective Leaching of Materials," to manage loss of material due to selective leaching for this component group. The applicant stated that this line item is not applicable because the ESF systems have no copper alloy piping, piping components, piping elements, or heat exchangers exposed to closed-cycle cooling water at DAEC. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the ESF systems that include copper alloy greater than 15 percent Zn piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water. The staff also noted that a search of the applicant's UFSAR and technical specifications did not find any evidence of copper alloy greater than 15 percent Zn piping, piping components, piping elements, and heat exchanger components in the ESF systems. Based on its review of the LRA, UFSAR, and technical specifications, the staff confirmed that there are no in-scope copper alloy greater than 15 percent Zn piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water in the ESF systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2-1, line item 3.2.1-42 addresses gray cast iron piping, piping components, and piping elements exposed to closed-cycle cooling water. The GALL Report recommends the use of GALL AMP XI.M33, "Selective Leaching of Materials," to manage loss of material due to selective leaching for this component group. The applicant stated that this line item is not applicable because the ESF systems have no cast iron piping, piping components, or piping elements exposed to closed-cycle cooling water at DAEC. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the ESF systems that include gray cast iron piping, piping components, and piping elements exposed to closed-cycle cooling water. The staff also noted that a search of the applicant's UFSAR and technical specifications did not find any evidence of gray cast iron piping, piping components, and piping elements in the ESF systems. Based on its review of the LRA, UFSAR, and technical specifications, the staff confirmed that there are no in-scope gray cast iron piping, piping components, and piping elements exposed to closed-cycle cooling water in the ESF systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2-1, line item 3.2.1-43 addresses gray cast iron piping, piping components, and piping elements exposed to soil. The GALL Report recommends the use of GALL AMP XI.M33, "Selective Leaching of Materials," to manage loss of material due to selective leaching for this component group. The applicant stated that this line item is not applicable because the ESF systems have no cast iron piping, piping components, and piping elements at DAEC. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the ESF systems that include gray cast iron piping, piping components, and piping elements exposed to soil. The staff also noted that a search of the applicant's UFSAR and technical specifications did not find any evidence of gray cast iron piping, piping components, and piping elements in the ESF systems. Based on its review of the LRA, UFSAR, and technical specifications, the staff confirmed that there are no in-scope gray cast iron piping, piping components, and piping elements exposed to soil in the ESF systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2-1, line item 3.2.1-44 addresses gray cast iron motor coolers exposed to treated water. The GALL Report recommends the use of GALL AMP XI.M33, "Selective Leaching of Materials," to manage loss of material due to selective leaching for this component group. The applicant stated that this line item is not applicable because the ESF systems have no cast iron motor coolers at DAEC. The staff reviewed LRA Sections 2.3.2 and 3.2 and confirmed that the applicant's LRA does not have any AMR results for the ESF systems that include gray cast iron motor coolers exposed to treated water. The staff also noted that a search of the applicant's UFSAR and technical specifications did not find any evidence of gray cast iron motor coolers in the ESF systems. Based on its review of the LRA, UFSAR, and technical specifications, the staff confirmed that there are no in-scope gray cast iron motor coolers exposed to treated water in the ESF systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.2-1, line item 3.2.1-54 addresses steel piping, piping components, and piping elements exposed to air-indoor uncontrolled and states that no AERMs or AMPs are recommended. The GALL Report, Table V, item V.F-16 (EP-4) recommends that there is no aging effect or aging mechanism and that no AMP is recommended for this component group. Therefore, the staff finds the applicant's determination acceptable.

3.2.2.1.2 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion, and Fouling

LRA Table 3.2-1, item 3.2.1-35 addresses the loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, as well as fouling of internal surfaces of steel containment isolation piping and components exposed to raw water.

The LRA credits the Open-Cycle Cooling Water Program to manage loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, as well as fouling of internal surfaces of steel containment isolation piping and components exposed to raw water. The GALL Report recommends that this aging effect be managed through the use of GALL AMP XI.M20, "Open-Cycle Cooling Water System Program." The AMR line items that reference this line item in GALL Report, Table 1 cite generic note E, indicating that the AMR line items are consistent with the GALL Report for material, environment, and aging effect, but a different AMP is credited.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.20.

The staff noted that the components that reference item 3.2.1-35 are included in LRA Tables 3.3.2-8 and 3.3.2-20. The staff also noted that it is only appropriate to use the Open-Cycle Cooling Water Program when the components are involved in transferring heat from safety-related equipment to the ultimate heat sink.

LRA Table 3.3.2-8 addresses components associated with the drywell sumps that are not involved in transferring heat from safety-related components to the ultimate heat sink. The staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program an appropriate means of managing aging because loss of material is adequately detected by visual inspection and the applicant's program contains appropriate visual inspection methods.

LRA Table 3.3.2-20 addresses components associated with the primary containment HVAC system. The staff noted that the heat exchangers associated with this system are included under 10 CFR 54.4(a)(2), meaning that they are not safety-related systems and have no components involved in transferring heat from safety-related components to the ultimate heat sink. The staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program an appropriate means of managing aging because loss of material is adequately detected by visual inspection and the applicant's proposed program contains appropriate visual inspection methods.

The staff also notes that the source of the cooling water for this system is well water. Since well water does not contain microbiological fouling agents, such as zebra mussels, and since it does not contain significant concentrations of particulate fouling agents, such as silt, most of the aspects of the Open-Cycle Cooling Water Program would not be applicable.

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).

The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing aging effects. On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are indeed consistent with its AMRs. Therefore, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.2.2, the applicant further evaluates aging management, as recommended by the GALL Report, for the ESFs components and provides information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to cladding breach
- loss of material due to pitting and crevice corrosion
- reduction of heat transfer due to fouling
- hardening and loss of strength due to elastomer degradation
- loss of material due to erosion
- loss of material due to general corrosion and fouling
- loss of material due to general, pitting, and crevice corrosion
- loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion
- QA for aging management of nonsafety-related components

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which the report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.2.2.2. The staff's review of the applicant's further evaluation follows.

3.2.2.2.1 Cumulative Fatigue Damage

LRA Section 3.2.2.2.1 states that 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

The staff reviewed LRA Section 3.2.2.2.2 against the criteria in SRP-LR Section 3.2.2.2.2.

LRA Section 3.2.2.2.2 addresses loss of material due to cladding breach. The applicant stated that this aging effect is not applicable because DAEC is a BWR.

SRP-LR Section 3.2.2.2.2 states that loss of material due to cladding breach may occur in PWR steel pump casings with stainless steel cladding exposed to treated borated water.

The staff concludes that the recommendations in SRP-LR 3.2.2.2.2 are not applicable because DAEC is not a PWR designed reactor.

Based on the above, the staff concludes that SRP-LR Section 3.2.2.2.2 criteria is not applicable.

3.2.2.2.3 Loss of Material Due to Pitting and Crevice Corrosion

The staff reviewed LRA Section 3.2.2.2.3 against the following criteria in SRP-LR Section 3.2.2.2.3:

(1) LRA Section 3.2.2.2.3.1 refers to Table 3.2-1, item 3.2.1-3 and addresses containment isolation stainless steel piping and components exposed to a treated water environment. The LRA states that these components are managed for loss of material due to pitting and crevice corrosion by the Water Chemistry Program and 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, including susceptible locations such as areas of stagnant flow.

The staff reviewed LRA Section 3.3.2.2.3.1 against the criteria in SRP-LR Section 3.3.2.2.3.1, which states that: (1) 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; (2) the existing AMP relies on monitoring and control of water chemistry to mitigate degradation; and (3) the effectiveness of the chemistry control program should be verified with a one-time inspection of select components at susceptible locations that is an acceptable method to determine to ensure that corrosion does not occur.

The staff reviewed the applicant's Water Chemistry Program and One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.1.26 and 3.0.3.1.21, respectively. The staff finds that these programs: (1) provide for periodic sampling of treated water to maintain contaminants at acceptable limits to preclude loss of material due to pitting and crevice corrosion, and (2) will perform one-time inspections of select containment isolation stainless steel piping and components exposed to a treated water environment for loss of material due to pitting and crevice corrosion to verify the effectiveness of the Water Chemistry Program in applicable ESF systems. The staff noted that the GALL Report states that a one-time inspection is an acceptable method to verify the effectiveness of a mitigative AMP such as the Water Chemistry Program.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.3.1 criteria. For those line items that apply to LRA Section 3.2.2.2.3.1, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) LRA Section 3.2.2.2.3.2 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 stated that stainless steel buried piping exposed to a soil environment is managed for loss of material due to crevice, microbiologically-influenced, and pitting corrosion by the Buried Piping and Tanks Inspection Program. The applicant also stated that the program relies on periodic inspection for loss of material caused by corrosion of the external surfaces of buried piping. The applicant further stated that the program includes preventive measures to mitigate corrosion and periodic inspections to manage the loss of material on the pressure-retaining capability of buried steel piping and tanks.

The staff reviewed LRA Section 3.2.2.2.3.2 against the criteria in SRP-LR Section 3.2.2.2.3.2, which states that loss of material from pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements exposed to soil.

The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed. The GALL Report states that acceptance criteria are described in BTP RSLB-1 (SRP-LR Appendix A.1).

The staff reviewed the applicant's Buried Piping and Tanks Inspection Program and its evaluation is documented in SER Section 3.0.3.1.7.

The staff reviewed the LRA and identified in Table 3.2.1, item 3.2.1-4 that the applicant will use the Buried Piping and Tanks Inspection Program to manage the aging effects of loss of material due to pitting and crevice corrosion. The staff noted that the applicant stated that items associated with item 3.2.1-4 are fully consistent with the GALL Report (generic note A). The staff also notes that the GALL Report indicates that the generic note for this item should be E. The staff further noted that the LRA AMP includes stainless steel while the GALL Report AMP does not. The staff finds that the LRA AMP is sufficient to adequately manage the aging of stainless steel because it contains appropriate inspection procedures to visually examine the exterior surfaces of the stainless steel piping for loss of material due to pitting or crevice corrosion at intervals consistent with the GALL Report AMP.

Based on the programs identified, the staff concludes that applicant's programs meet SRP-LR Section 3.2.2.2.3.2 criteria and, therefore, the applicant's AMR results are consistent with the ones under GALL Report, item V.D2-27.

(3) LRA Section 3.2.2.2.3 addresses loss of material due to pitting and crevice corrosion in stainless steel and aluminum piping, piping components, and piping elements exposed to treated water. The applicant stated that loss of material due to pitting and crevice corrosion in stainless steel and CASS piping and components in a treated water environment will be managed by the Water Chemistry and 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 including susceptible locations such as areas of stagnant flow.

The staff reviewed LRA Section 3.2.2.2.3 against the criteria described in SRP-LR Section 3.2.2.2.3, which states that loss of material due to pitting and crevice corrosion could occur for stainless steel and aluminum piping, piping components, and piping elements exposed to treated water. The SRP-LR also states that the AMP relies on monitoring and control of water chemistry to mitigate degradation, and a one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect does not occur or is progressing very slowly such that the component's intended function will be maintained during the period of extended operation. The GALL Report, under item V.D2-28, recommends managing the aging effect using the Water Chemistry Program augmented by the One-Time Inspection Program to verify the effectiveness of the chemistry control program.

The staff reviewed the LRA and identified in Table 3.2.1, item 3.2.1-5 that the applicant will use the Water Chemistry and One-Time Inspection programs to manage the loss of material due to pitting and crevice corrosion for these particular components. The staff reviewed the applicant's Water Chemistry and the One-Time Inspection programs, which are evaluated in SER Sections 3.0.3.1.26 and 3.0.3.1.21, respectively. The applicant stated that the One-Time Inspection Program includes identification of inspection locations based on the most susceptible to the potential corrosion mechanism (e.g., stagnant flow areas), selection of the examination technique with acceptance criteria, and evaluation of the results including the need for additional inspections or other corrective actions. The staff finds that the credited programs are appropriate because: (1) the Water Chemistry Program will establish the plant water chemistry control parameters and identify the actions required if the parameters exceed limits, and (2) the One-Time Inspection Program will include a one-time inspection of select components to verify the effectiveness of the Water Chemistry Program for managing the effects of aging due to the potential corrosion mechanisms. The staff also finds the applicant's management of the effect of aging acceptable because it requires inspections at appropriate locations (e.g., stagnant low flow). The staff finds that the applicant satisfied the acceptance criteria in SPR-LR Section 3.2.2.2.3 and, therefore, the applicant's AMR results are consistent with the GALL Report item V.D2-28.

LRA Table 3.2-1, item 3.2.1-5 addresses loss of material due to pitting and crevice corrosion in stainless steel and aluminum piping, piping components, and piping elements exposed to treated water. The applicant stated that this item is, in part not applicable, because the ESFs have no aluminum components exposed to treated water. The staff reviewed the UFSAR to verify the design of the ESF system. Based on information in the UFSAR, the staff confirmed that the applicant's plant does not have aluminum components in the ESF system. Therefore, the staff finds that this item is not applicable.

Based on the program identified, the staff concludes that the applicant's program meets SRP–LR Section 3.2.2.2.3.3 criteria. For those line items that apply to LRA Section 3.2.2.2.3.3, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(4) LRA Section 3.2.2.2.3.4 refers to Table 3.2-1, item 3.2.1-6 and addresses stainless steel components exposed to lubricating oil. The LRA states that: (1) these components are being managed for loss of material due to pitting and crevice corrosion by the Lubricating Oil Analysis Program; (2) the Lubricating Oil Analysis Program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion; (3) the effectiveness of the Lubricating Oil Analysis Program will be confirmed by the One-Time Inspection Program; and (4) crevice and pitting corrosion are not applicable mechanisms for copper alloy components with less than 15 percent Zn and aluminum bronze components with less than 8 percent aluminum in a fuel oil or lube oil environment.

The staff reviewed LRA Section 3.2.2.2.3.4 against the criteria in SRP-LR Section 3.2.2.2.3.4, which states that loss of material from pitting and crevice corrosion could occur for stainless steel and copper alloy piping, piping components, and piping elements exposed to lubricating oil. SRP-LR Section 3.2.2.2.3.4 further states that the existing program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits and the effectiveness of lubricating oil control should be verified with a one-time inspection of selected components at susceptible locations.

The staff reviewed the applicant's Lubricating Oil Analysis and One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.8 and 3.0.3.1.21, respectively, and finds that these programs: (1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material and (2) will perform one-time inspections of select stainless steel and copper alloy components exposed to lubricating oil for loss of material due to pitting and crevice corrosion to verify the effectiveness of the Lubricating Oil Analysis Program in applicable ESF systems. The staff noted that the GALL Report states that a one-time inspection is an acceptable method to verify the effectiveness of a mitigative AMP such as the Lubricating Oil Analysis Program. The staff noted that the applicant is crediting the Lubricating Oil Analysis Program as recommended in the GALL Report and the applicant is verifying the effectiveness of the Lubricating Oil Analysis Program with the elements of the One-Time Inspection Program. The staff finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.3.4.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.3.4 criteria. For those line items that apply to LRA Section 3.2.2.2.3.4, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(5) LRA Section 3.2.2.2.3.5 addresses loss of material due to pitting and crevice corrosion in partially encased tanks exposed to raw water. The applicant stated that this aging effect is not applicable because there are no partially encased stainless steel tanks exposed to raw water for DAEC.

SRP-LR Section 3.2.2.2.3.5 states that loss of material due to pitting and crevice corrosion may occur in partially encased stainless steel tanks exposed to raw water due to cracking of the perimeter seal from weathering. The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed. The GALL Report recommends that a plant-specific AMP be evaluated because moisture and water can egress under the tank if the perimeter seal is degraded.

The staff reviewed UFSAR Chapters 5.4 and 6.3 and noted that the CSTs are the primary source of water, which is then transferred to the suppression pool for the ESF systems. The staff noted that LRA Section B.3.2 states that the scope of the applicant's Aboveground Steel Tanks Program includes its CSTs, 1T005A and 1T005B. The staff noted that both CSTs are fabricated of carbon steel and are managed by the applicant's Aboveground Steel Tanks Program.

Therefore, the staff determined that the applicant does not have stainless steel tanks in its ESF systems located outdoors and exposed to raw water due to cracking of the perimeter seal from weathering and that SRP-LR Section 3.2.2.2.3.5 is not applicable.

(6) LRA Section 3.2.2.2.3.6 addresses loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, piping elements, and tanks exposed to internal condensation. The applicant stated that loss of material due to pitting and crevice corrosion in stainless steel components in an internal condensation environment will be managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

The staff reviewed LRA Section 3.2.2.2.3.6 against the criteria described in SRP-LR Section 3.2.2.2.3.6, which states that loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, piping elements, and tanks exposed to internal condensation. It further states that the acceptance criteria for the further evaluation of the plant-specific AMP are described in BTP RSLB-1. The GALL Report, under item V.D2-35, recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

The staff reviewed the LRA and identified in Table 3.2.1, item 3.2.1-8 that the applicant will use the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage the loss of material due to pitting and crevice corrosion for these particular components. The staff also reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, which is evaluated in SER Section 3.0.3.1.20. The staff finds that the credited program is acceptable because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program: (1) requires periodic visual inspections of the component internal surfaces to ensure that existing environmental conditions are not causing material degradation that could result in a loss of the component's intended function, and (2) contains appropriate visual inspection methods and acceptance criteria.

The staff finds that the applicant satisfied the acceptance criteria in SRP-LR Section 3.2.2.2.3.6 and, therefore, the applicant's AMR results are consistent with the one under GALL Report, item V.D2-35.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.3 criteria. For those line items that apply to LRA Section 3.2.2.2.3, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.4 Reduction of Heat Transfer Due to Fouling

The staff reviewed LRA Section 3.2.2.2.4 against the following criteria in SRP-LR Section 3.2.2.2.4:

(1) LRA Section 3.2.2.2.4.1 refers to Table 3.2-1, item 3.2.1-9 and addresses heat exchanger tubes exposed to lubricating oil. The LRA states that these components are being managed for reduction of heat transfer due to fouling by the Lubricating Oil Analysis Program and the effectiveness of the Lubricating Oil Analysis Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting the program, including susceptible locations, such as areas of stagnant flow.

The staff reviewed LRA Section 3.2.2.2.4.1 against the criteria in SRP-LR Section 3.2.2.2.4.1, which states that reduction of heat transfer due to fouling could occur for steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil. SRP-LR Section 3.2.2.2.4.1 further states that: (1) the existing AMP relies on monitoring and control of lube oil chemistry to mitigate reduction of heat transfer due to fouling, (2) the effectiveness of lube oil chemistry control should be verified to ensure that fouling does not occur, and (3) a one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect does not occur or an aging effect is progressing very slowly.

The staff reviewed the applicant's Lubricating Oil Analysis and One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.8 and 3.0.3.1.21, respectively, and finds that these programs: (1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude fouling, and (2) will perform one-time inspections of select stainless steel and copper alloy heat exchanger tubing exposed to lubricating oil for loss of heat transfer due to fouling to verify the effectiveness of the Lubricating Oil Analysis Program in applicable ESF systems. The staff noted that the GALL Report states that one-time inspection is an acceptable method to verify the effectiveness of a mitigative AMP such as the Lubricating Oil Analysis Program. The staff noted that the applicant is crediting the Lubricating Oil Analysis Program as recommended in the GALL Report, and the applicant is verifying effectiveness of the Lubricating Oil Analysis Program with the elements of the One-Time Inspection Program. The staff finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.4.1.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.4.1 criteria. For those line items that apply to LRA Section 3.2.2.2.4.1, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) LRA Section 3.2.2.2.4.2 refers to Table 3.2-1, item 3.2.1-10 and addresses stainless steel heat exchanger tubes exposed to treated water. The LRA states that these components are being managed for reduction of heat transfer due to fouling by the Water Chemistry Program and 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 susceptible locations, such as areas of stagnant flow.

The staff reviewed LRA Section 3.3.2.2.4.2 against the criteria in SRP-LR Section 3.3.2.2.4.2, which states that: (1) reduction of heat transfer due to fouling could occur for stainless steel heat exchanger tubes exposed to treated water, (2) the existing program relies on control of water chemistry to manage reduction of heat transfer due to fouling, and (3) control of water chemistry may have been inadequate; therefore, the GALL Report recommends that the effectiveness of the chemistry control program should be verified with one-time inspections to ensure that reduction of heat transfer due to fouling does not occur.

The staff reviewed the applicant's Water Chemistry Program and One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.1.26 and 3.0.3.1.21, respectively. The staff finds that these programs: (1) provide for periodic sampling of treated water to maintain contaminants at acceptable limits to preclude reduction of heat transfer due to fouling, and (2) will perform one-time inspections of select stainless steel heat exchanger tubes exposed to treated water for reduction of heat transfer due to fouling to verify the effectiveness of the Water Chemistry Program in applicable ESF systems. The staff noted that the GALL Report states that a one-time inspection is an acceptable method to verify the effectiveness of a mitigative AMP such as the Water Chemistry Program.

Therefore, the staff finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.4.2.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.4 criteria. For those line items that apply to LRA Section 3.2.2.2.4, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.5 Hardening and Loss of Strength Due to Elastomer Degradation

LRA Section 3.2.2.2.5 addresses the applicant's aging management basis for managing hardening and loss of strength due to elastomer degradation in elastomer seals and components in the standby gas treatment system exposed to air-indoor uncontrolled. In the LRA the applicant stated that at DAEC the ESF standby gas treatment system has no elastomer seals or components associated with ductwork or filters. In LRA Table 3.2-1, item 3.2.1-11, the applicant stated that the item is not applicable.

The staff reviewed LRA Section 3.2.2.2.5 against the criteria in SRP-LR Section 3.2.2.2.5, which states that hardening and loss of strength due to elastomer degradation could occur in elastomer seals and components associated with the BWR standby gas treatment system ductwork and filters exposed to air-indoor uncontrolled. The SRP-LR also states that the GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

SRP-LR Section 3.2.2.2.5 references AMR item 11 in Table 2 of the GALL Report, Volume 1, and GALL AMR item V.B-4 (E-06), applicable to elastomer seals and components exposed to air-indoor uncontrolled in the standby gas treatment system.

The staff noted the applicant's statement that its standby gas treatment system contains no elastomer seals or components associated with ductwork or filters, and during its review the staff found no instances of elastomer seals or components being used in standby gas treatment ducting.

On the basis that the standby gas treatment system contains no elastomer seals or components, the staff finds it acceptable for the applicant to designate LRA Table 3.2-1, item 3.2.1-11 as not applicable.

3.2.2.2.6 Loss of Material Due to Erosion

The staff reviewed LRA Section 3.2.2.2.6 against the criteria in SRP-LR Section 3.2.2.2.6.

LRA Section 3.2.2.2.6 addresses loss of material due to erosion. The applicant stated that this aging effect is not applicable because DAEC is a BWR plant.

SRP-LR Section 3.2.2.2.6 states that loss of material due to erosion may occur in the stainless steel high-pressure safety injection (HPSI) pump miniflow recirculation orifice exposed to treated borated water.

The staff concludes that the recommendations in SRP-LR 3.2.2.2.6 are not applicable because DAEC is not a PWR designed reactor.

Based on the above, the staff concludes that SRP-LR Section 3.2.2.2.6 criteria is not applicable.

3.2.2.2.7 Loss of Material Due to General Corrosion and Fouling

The staff reviewed LRA Section 3.2.2.2.7 against the criteria in SRP-LR Section 3.2.2.2.7.

LRA Table 3.2-1, item 3.2.1-13 addresses loss of material due to general corrosion and fouling in steel drywell and suppression chamber spray system nozzles and flow orifices with internal surfaces exposed to air-indoor uncontrolled. The applicant stated that this item is not applicable because the ESFs have no steel spray nozzles or orifices in an air-indoor uncontrolled environment. The staff reviewed the UFSAR to verify the design of the ESFs system. Based on information in the UFSAR, the staff confirmed that the applicant’s plant does not have steel spray nozzles or orifices in the ESFs system. Therefore, the staff finds that this item is not applicable.

Based on the above, the staff concludes that SRP-LR Section 3.2.2.2.7 criteria is not applicable.

3.2.2.2.8 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.2.2.2.8 against the following criteria in SRP-LR Section 3.2.2.2.8:

(1) LRA Section 3.2.2.2.8.1 addresses loss of material due to general, pitting, and crevice corrosion in BWR steel piping, piping components, and piping elements exposed to treated water. The applicant stated that loss of material due to general, pitting, and crevice corrosion in BWR carbon steel piping, piping components, and piping elements in a treated water environment will be managed by the Water Chemistry Program and 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 this program including susceptible locations such as areas of stagnant flow.

    The staff reviewed LRA Section 3.2.2.2.8.1 against the criteria described in SRP-LR Section 3.2.2.2.8.1, which states 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 SRP-LR also states that the AMP relies on monitoring and control of water chemistry to mitigate degradation and a one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect does not occurring or is progressing very slowly such that the component’s intended function will be maintained during the period of extended operation. The GALL Report, under item V.D2-33, recommends managing the aging effect using the Water Chemistry Program augmented by the One-Time Inspection Program to verify the effectiveness of the chemistry control program.

The staff reviewed LRA Table 3.2.1, item 3.2.1-14 and noted that for items that are either fully consistent with the GALL Report (generic note A) or consistent with the GALL Report in all respects except the component is different (generic note C), the applicant will use the Water Chemistry and One-Time Inspection programs to manage the loss of material due to general, pitting, and crevice corrosion for these particular components. The staff also reviewed the applicant's Water Chemistry and One-Time Inspection programs, which are evaluated in SER Sections 3.0.3.1.26 and 3.0.3.1.21, respectively. The applicant stated that the One-Time Inspection Program includes identification of inspection locations based on the most susceptible to the potential corrosion mechanism (e.g., stagnant flow areas), selection of the examination technique with acceptance criteria, and evaluation of the results including the need for additional inspections or other corrective actions. The staff finds that the credited programs are appropriate because: (1) the Water Chemistry Program will establish the plant water chemistry control parameters and identify the actions required if the parameters exceed limits, and (2) the One-Time Inspection Program will include a one-time inspection of select components to verify the effectiveness of the Water Chemistry Program for managing the effects of aging due to the potential corrosion mechanisms. The staff also finds the applicant's management of the effect of aging acceptable because it requires inspections at appropriate locations (e.g., stagnant low flow). The staff finds that the applicant satisfied the acceptance criteria in SPR-LR Section 3.2.2.2.8.1 and, therefore, the applicant's AMR results are consistent with the one under GALL Report, item V.D2-33.

The staff reviewed LRA Table 3.2.1, item 3.2.1-14 and noted that for items that are consistent with the GALL Report item for material, environment, and aging effect, but a different AMP is credited (generic note E), the applicant will use the Bolting Integrity Program to manage the loss of material due to general, pitting, and crevice corrosion for these particular components. The staff reviewed the applicant's Bolting Integrity Program and its evaluation is documented in SER Section 3.0.3.1.6. The staff noted that the component/environment under consideration is "fastener, bolting, washers, nuts" exposed to treated water. The staff finds the applicant's proposed use of the Bolting Integrity Program to be acceptable because this AMP is specifically designed to address aging associated with bolting including loss of material due to corrosion and loss of preload. The staff finds the applicant satisfied the acceptance criteria in SPR-LR Section 3.2.2.2.8.1 and, therefore, the applicant's AMR results are consistent with the one under GALL Report, item V.D2-33.

Based on the program identified, the staff concludes that the applicant's program meets SRP-LR Section 3.2.2.2.8.1 criteria. For those line items that apply to LRA Section 3.2.2.2.8.1, the staff determined that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) LRA Section 3.2.2.2.8.2 refers to Table 3.2-1, item 3.2.1-15 and addresses steel containment isolation piping, piping components, and piping elements exposed to treated water. The LRA states that these components are being managed for loss of material due to general, crevice, and pitting corrosion by the Water Chemistry Program and 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 suscetible locations, such as areas of stagnant flow.

The staff reviewed LRA Section 3.3.2.2.8.2 against the criteria in SRP-LR Section 3.3.2.2.8.2, which states that: (1) 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; (2) the existing AMP relies on monitoring and control of water chemistry to mitigate degradation; and (3) control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations of stagnant flow conditions; therefore, the effectiveness of the Water Chemistry Control Program should be verified with one-time inspections of select components at susceptible locations to ensure that corrosion does not occur.

The staff reviewed the applicant’s Water Chemistry Program and One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.1.26 and 3.0.3.1.21, respectively The staff finds that these programs: (1) provide for periodic sampling of treated water to maintain contaminants at acceptable limits to preclude loss of material due to general, pitting, and crevice corrosion that could occur for components exposed to treated water; and (2) will perform one-time inspections of select internal surfaces of steel containment isolation piping, piping components, and piping elements exposed to treated water for loss of material due to general, pitting, and crevice corrosion to verify the effectiveness of the Water Chemistry Program in applicable ESF systems. The staff noted that the GALL Report states that a one-time inspection is an acceptable method to verify the effectiveness of a mitigative AMP such as the Water Chemistry Program. Therefore, the staff finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.8.2.

Based on the programs identified, the staff concludes that the applicant’s programs meet SRP-LR Section 3.2.2.2.8.2 criteria. For those line items that apply to LRA Section 3.2.2.2.8.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(3) LRA Section 3.2.2.2.8.3 refers to Table 3.2-1, item 3.2.1-16 and addresses steel piping, piping components, and piping elements exposed to lubricating oil. The LRA states that these components are managed for loss of material due to general, crevice, and pitting corrosion by the Lubricating Oil Analysis Program which includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion; and that the effectiveness of the Lubricating Oil Analysis Program will be confirmed by the One-Time Inspection Program.

SRP-LR Section 3.2.2.2.8.3 states that, loss of material due to general, pitting, and crevice corrosion could occur for steel piping, piping components, and piping elements exposed to lubricating oil. The existing program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The staff noted that the GALL Report recommends further evaluation to verify the effectiveness of the lubricating oil program and that a one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur.

The staff reviewed the applicant's Lubricating Oil Analysis and One-Time Inspection programs and its evaluations are documented in SER Sections 3.0.3.2.8 and 3.0.3.1.21, respectively, and finds that these programs: (1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material and (2) will perform one-time inspections of select steel piping, piping components, and piping elements exposed to lubricating oil for loss of material due to general, pitting, and crevice corrosion to verify the effectiveness of the Lubricating Oil Analysis Program in applicable ESF systems. The staff noted that the GALL Report states that one-time inspection is an acceptable method to verify the effectiveness of a mitigative AMP, such as the Lubricating Oil Analysis Program. The staff noted that the applicant is crediting the Lubricating Oil Analysis Program as recommended in the GALL Report and the applicant is verifying effectiveness of the Lubricating Oil Analysis Program with the elements of the One-Time Inspection Program.

The staff finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.8.3.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.2.2.2.8 criteria. For those line items that apply to LRA Section 3.2.2.2.8, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.9 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion

The staff reviewed LRA Section 3.2.2.2.9 against the following criteria in SRP-LR Section 3.2.2.2.9.

LRA Section 3.2.2.2.9 addresses loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion which could occur for steel piping (with or without coating or wrapping), uncoated cast iron and stainless piping, piping components, and piping elements buried in soil. The applicant stated that loss of material for steel piping, cast iron and stainless components with an external environment of soil is being managed by the Buried Piping and Tanks Inspection Program. In the LRA, the applicant credits the Buried Piping and Tanks Inspection Program to 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 3.2.2.2.9 against the criteria in SRP-LR Section 3.2.2.2.9, which states that loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion could occur for steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil. The GALL Report states that the Buried Piping and Tanks Inspection Program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, crevice, and microbiologically-influenced corrosion. The SRP also states that the effectiveness of the Buried Piping and Tanks Inspection Program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material does not occur.

The staff reviewed the applicant's Buried Piping and Tanks Inspection Program and its evaluation is documented in SER Section 3.0.3.1.7.

The GALL Report recommends further evaluation of the effectiveness of the applicant's Buried Piping and Tanks Inspection Program based on its operating history. In its audit of the applicant's Buried Piping and Tanks Inspection Program, the staff found no operating history which would indicate a need for a change to the Buried Piping and Tanks Inspection Program. The staff finds that the LRA AMP is sufficient to adequately manage the aging of steel because it contains appropriate inspection procedures to visually examine the exterior surfaces of the steel piping for loss of material due to pitting or crevice corrosion at intervals consistent with the GALL AMP. The LRA AMP satisfies the acceptance criteria in SRP-LR 3.2.2.2.9 and, therefore, the applicant's AMR results are consistent with the GALL Report, item V.B-9.

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, as required by 10 CFR 54.21(a)(3)

3.2.2.2.10 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA program.

3.2.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.2.2-1 through 3.2.2-6, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

In LRA Tables 3.2.2-1 through 3.2.2-6, the applicant indicated, via notes F through J, that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 Summary of Aging Management Review Results – Reactor Core Isolation Cooling System

LRA Table 3.2.2-4 addresses aging management evaluations for components within the ESF systems relating to the RCIC system. The applicant stated that for heat exchangers, condensers, coolers, and fan coils made of brass or bronze in a lubricating oil environment, no AERMs were found. Therefore, no AMP was assigned for these component/material/environment combinations. The staff noted that the GALL Report, under item V.D2-22, recommends the use of the Lubricating Oil Analysis Program augmented by the One-Time Inspection Program to manage the aging effect of loss of material due to pitting and crevice corrosion in copper alloy piping, piping components, and piping elements exposed to lubricating oil.

The staff evaluated the applicant's AMR and by letter dated January 6, 2010, the staff issued RAI BF76-3 requesting that the applicant explain why brass or bronze is not subject to pitting and crevice corrosion in a lubricating oil environment. In its response dated February 2, 2010, the applicant stated that the brass and bronze materials used in these components contains less than 15 percent Zn and, thus, are resistant to pitting and crevice corrosion. The applicant also stated that the wrong footnote had been specified, in that the footnote should have been 225, "Crevice and pitting corrosion are not applicable aging mechanisms for copper alloy components with less than 15% zinc and aluminum bronze components with less than 8% aluminum in fuel oil and lube oil environments." Based on its review, the staff finds the applicant's response to RAI BF76-3 acceptable because it conforms with GALL Report Table IX.C which states in part, "The broad purpose of this material category is to collect those copper alloys whose critical alloying elements are less than certain thresholds that keep the alloy from being susceptible to aging effects. For example, copper, copper nickel, brass, bronze <15% zinc, and aluminum bronze <8% aluminum are resistant to stress corrosion cracking, selective leaching and pitting and crevice corrosion." The staff's concern described in RAI BF76-3 is resolved.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.2 Stainless Steel Fasteners, Bolting, Washers, and Nuts Exposed to Air-Indoor Uncontrolled (External)

LRA Tables 3.2.2-1, 3.2.2-3, 3.2.2-5, and 3.2.2-6 state that stainless steel fasteners, bolting, washers, and nuts exposed to air-indoor uncontrolled (external) have an aging effect of loss of preload and that the aging effect is managed by the Bolting Integrity Program. The AMR line items (LRA pages 3.2-24, -42, -56, and -65) cite note F, indicating that the material is not in the GALL Report for this component.

The staff reviewed all AMR result lines (unique items) in the GALL Report where the component type is bolting and confirmed that there are no entries for bolting material made of stainless steel exposed to air-indoor uncontrolled (external) where the aging effect is loss of preload. This review confirmed that the applicant's use of generic note F is acceptable.

The staff noted that the mechanisms listed in the GALL Report that cause loss of preload in carbon steel or low alloy bolting material (thermal effects, gasket creep, and self-loosening) can also cause loss of preload in stainless steel bolting. The staff also noted that activities in the Bolting Integrity Program that manage the aging effect of loss of preload are equally effective for carbon steel and stainless steel bolts. The staff further noted that the GALL Report (item V.E-5 (EP-24)) recommends using the Bolting Integrity Program to manage the aging effect of loss of preload in carbon steel bolts exposed to air-indoor uncontrolled. On the basis that the Bolting Integrity Program's activities for managing loss of preload are applicable for both carbon steel and stainless steel bolts and the GALL Report recommends the Bolting Integrity Program for managing loss of preload in carbon steel bolting, the staff finds the applicant's use of the Bolting Integrity Program to manage loss of preload in stainless steel bolts exposed to air-indoor uncontrolled 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, as required by 10 CFR 54.21(a)(3).

3.2.2.3.3 Cast Iron Valves and Dampers Exposed to Internal Condensation

In LRA Table 3.2.2-2 the applicant stated that cast iron valves and dampers exposed to internal condensation are being managed for loss of material by the Selective Leaching Program. The applicant cited generic note G, indicating that the environment is not in the GALL Report for this component and material.

The staff reviewed all AMR result lines in the GALL Report where the material is cast iron and the aging effect is loss of material. The staff notes that cast iron is included in the GALL Report definition of steel and that the recommended program for steel components exposed to internal condensation is the "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program." The staff also notes that the applicant stated that it will manage the effect of loss of material for cast iron valves and dampers using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program under line item 3.3.1-71, which is in accordance with the recommendations in the GALL Report. The staff further notes that the GALL Report states that cast iron is susceptible to selective leaching in its definition of grey cast iron and that there are no AMR result lines in the GALL Report for grey cast iron exposed to internal condensation.

The staff reviewed the applicant's Selective Leaching Program and its evaluation is documented in SER Section 3.0.1.3.24. The staff notes that the GALL Report recommends the "Selective Leaching Program" to manage the effects of loss of material for grey cast iron components exposed to raw and treated water. The staff also notes that raw and treated water has similar corrosion mechanisms to that of condensation due to the ability of condensation to concentrate contaminants. The staff finds the applicant's currently proposed aging management program acceptable because the applicant is managing the effects of loss of material for cast iron valves and dampers in accordance with the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, as recommended by the GALL Report and because the Selective Leaching Program performs inspections and hardness measurements or mechanical tests which are capable of detecting loss of material due to selective leaching.

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).

3.2.2.3.4 Carbon Steel Pipe, Pipe Fittings, Hoses, Tubes, Rupture Disks and Valves Exposed to Treated Water (Internal)

In LRA Tables 3.2.2-2 and 3.2.2-5, the applicant stated the carbon steel piping, pipe fittings, hoses, tubes, rupture disks, and valves, dampers exposed to treated water are being managed for loss of material by the Flow-Accelerated Corrosion Program. The AMR line items cite generic note H, indicating that for the line items, the aging effect is not in the GALL Report for this component, material, and environment combination. The applicant also cited plant-specific note 222 for each of the associated line items, which stated that erosion had occurred on some components, as described in the plant operating experience database, and that the loss of material due to erosion for these components is managed by the Flow-Accelerated Corrosion Program.

The staff reviewed all AMR result line items in the GALL Report where the component and material is carbon steel piping, pipe fittings, hoses, tubes, rupture disks, and valves, dampers exposed to treated water and confirmed that there are no aging effect entries in the GALL Report for this component, material, and environment combination.

The staff reviewed the applicant’s Flow-Accelerated Corrosion Program and its evaluation is documented in SER Section 3.0.3.1.17. The staff finds the applicant’s currently proposed AMP acceptable because, as clarified in its follow-up response to RAI B3.24-1 dated February 2, 2010, the applicant provided details on their Flow-Accelerated Corrosion Program including stating that the program includes inspection of locations susceptible to erosion based on operating experience, uses the same techniques as those used for measuring wall thinning due to flow-accelerated corrosion, trends inspection results, and initiates corrective actions prior to loss of intended function. This AMP is capable of detecting and managing the loss of material due to erosion in carbon steel pipe, components, and valves exposed to treated water.

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).

3.2.2.3.5 Cast Iron Pumps, Pump Elements, Piping, Piping Elelments, Heat Exchanger and Heat Exchanger Elements Exposed to Lubricating Oil

In LRA Tables 3.2.2-2, 3.2.2-4, 3.4.2-5, the applicant stated that cast iron pumps and pump elements, piping and piping elements (valves, dampers), instrumentation and instrumentation elements exposed to lubricating oil are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program. The AMR line items cite generic note G, indicating that for the line items the environment is not in the GALL Report for this component and material. The applicant also cited plant specific note 207 for each of the associated line items, which stated that “Material/environment combination and/or aging effect/mechanism not identified in NUREG-1801. The aging management program(s) referenced are appropriate for the aging effects/mechanisms identified and provide assurance that the aging effects/mechanisms are effectively managed through the period of extended operation.”

The staff reviewed all AMR result line items in the GALL Report where the material is cast iron and the aging effect and mechanism is loss of material due to selective leaching and confirmed that for this environment, there are no entries in the GALL Report for this component and material.

In LRA Tables 3.3.2-29, 3.4.2-5, the applicant stated that cast iron pumps and pump elements, piping and piping elements (filters, screens, strainers, valves, dampers) exposed to lubricating oil or fuel oil are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program. The AMR line items cite the generic note H, indicating that for the line items, the aging effect is not in the GALL Report for this component, material, and environment combination. The applicant also cited plant-specific note 207 for each of the associated line items.

The staff reviewed all AMR result line items in the GALL Report where the component and material are cast iron and pumps and pump elements, piping and piping elements exposed to lubricating oil or fuel oil and confirmed that there are no aging effect entries in the GALL Report for this component, material, and environment combination.

In LRA Table 3.3.2-11, the applicant stated that cast iron heat exchangers and heat exchanger elements exposed to lubricating oil are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program. The AMR line items cite the generic note J, indicating that for these line items, neither the component nor the material and environment combination is evaluated in the GALL Report. The applicant also cited plant specific note 207 for each of the associated line items.

The staff reviewed all AMR result line items in the GALL Report where the component and material is cast iron heat exchangers and heat exchanger elements and confirmed that there are no entries for this component and material where the aging effect and mechanism is loss of material due to selective leaching.

The staff reviewed the applicant's Selective Leaching of Materials Program and its evaluation is documented in SER Section 3.0.3.1.24. The staff notes that the GALL Report states that cast iron is susceptible to selective leaching in its definition of grey cast iron. The staff also notes that the GALL Report recommends the "Selective Leaching of Materials Program" to manage the effects of loss of material due to selective leaching for grey cast iron components exposed to raw and treated water and that lubricating oil is less corrosive than raw water. The staff finds the applicant's currently proposed AMP acceptable because the Selective Leaching of Materials Program performs inspections and hardness measurements or mechanical tests which are capable of detecting loss of material due to selective leaching.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the engineered safety features components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3 Aging Management of Auxiliary Systems

This section of the SER documents the staff's review of the applicant's AMR results for the auxiliary systems components and component groups of:

- auxiliary heating boiler
- building sumps
- chlorination and acid feed system
- circulating water system
- containment atmosphere control system
- control building heating, ventilation, and air conditioning
- control rod drive system
- drywell sumps
- electrical manhole sump pump
- emergency service water system
- fire protection system
- fuel pool cooling and cleanup system
- general service water system
- hydrogen water chemistry system
- instrument air system
- intake and traveling screens
- off-gas exhaust system
- plant ventilation
- post-accident sampling system
- primary containment heating, ventilation, and air conditioning
- reactor building and radwaste building sampling system
- reactor building closed cooling water system
- reactor building heating, ventilation, and air conditioning
- reactor water cleanup system
- residual heat removal service water system
- river water supply system
- safety-related air system
- solid and liquid radwaste
- standby diesel generators
- standby liquid control system
- turbine building sampling system
- well water system
- zinc injection system

3.3.1 Summary of Technical Information in the Application

LRA Section 3.3 provides AMR results for the auxiliary systems components and component groups. LRA Table 3.3.1, "Summary of Aging Management Evaluations in Chapter VII NUREG-1801 of Auxilliary Systems," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the auxiliary systems components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.3.2 Staff Evaluation

The staff reviewed LRA Section 3.3 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the auxiliary systems components within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted an onsite audit of AMRs to ensure the applicant's claim that certain AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluations of the AMPs are documented in SER Section 3.0.3. Details of the staff's audit evaluation are documented in SER Section 3.3.2.1.

In the onsite audit, the staff also selected AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the SRP-LR Section 3.3.2.2 acceptance criteria. The staff's audit evaluations are documented in SER Section 3.3.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with or not addressed in the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed were appropriate for the material-environment combinations specified. The staff's evaluations are documented in SER Section 3.3.2.3.

For SSCs which the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR line items and the plant's operating experience to verify the applicant's claims.

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 3.3.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the auxiliary systems components:

- ASME Section XI In-service Inspection, IWB, IWC, and IWD Program
- Bolting Integrity Program
- BWR CRD Return Line Nozzle Program
- BWR Reactor Water Cleanup Program
- BWR SCC Program
- Buried Piping and Tanks Inspection Program
- Closed Cycle Cooling Water System Program
- Compressed Air Monitoring Program
- External Surfaces Monitoring Program
- Fire Protection Program
- Fire Water System Program
- Flow-Accelerated Corrosion Program
- Fuel Oil Chemistry Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Lubricating Oil Analysis Program
- One-Time Inspection Program
- Open-Cycle Cooling Water System Program
- Selective Leaching of Materials Program
- Water Chemistry Program

LRA Tables 3.3.2-1 through 3.3.2-33 summarize AMRs for the auxiliary systems components and indicate AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency with the report and for which it does not recommend further evaluation, the staff's audit and review determined whether the plant-specific components of these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant noted for each AMR line item how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A through E indicating how the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report and validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report and verified that the identified exceptions to the GALL Report AMPs have been reviewed and accepted. The staff also determined whether the applicant's AMP was consistent with the GALL Report AMP and whether the AMR was valid for the site-specific conditions.

Note C indicates that the component for the AMR line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report; however, the applicant identified in the GALL Report a different component with the same material, environment, aging effect, and AMP as the component under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicates that the component for the AMR line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report. The staff confirmed whether the AMR line item of the different component was applicable to the component under review and whether the identified exceptions to the GALL Report AMPs have been reviewed and accepted. The staff also determined whether the applicant's AMP was consistent with the GALL Report AMP and whether the AMR was valid for the site-specific conditions.

Note E indicates that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but credits a different AMP. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the credited AMP would manage the aging effect consistently with the GALL Report AMP and whether the AMR was valid for the site-specific conditions.

The staff audited and reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the auxiliary systems components that are subject to an AMR. On the basis of its audit and review, the staff determines that, for AMRs not requiring further evaluation, as identified in LRA Table 3.3.1, the applicant's references to the GALL Report are acceptable and no further staff review is required, 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 subsection that follows.

3.3.2.1.1 AMR Results Identified as Not Applicable

In LRA Table 3.3-1, line item 3.3.1-10 addresses high-strength steel closure bolting exposed to air with steam or water leakage. The GALL Report recommends use of GALL AMP XI.M18, "Bolting Integrity," augmented by an appropriate inspection to manage cracking due to cyclic loading or SCC for this component group if bolts are not replaced during maintenance. The applicant stated that this line item is not applicable because high-strength steel bolting is not used in the auxiliary systems. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that the applicant's LRA does not have any AMR results for the auxiliary systems that include high-strength steel closure bolting exposed to air with steam or water leakage. The staff also noted that a search of the Audit Report did not find any evidence of high-strength steel closure bolting exposed to air with steam or water leakage in the auxiliary systems. Based on its review of the LRA and audit interviews, the staff confirmed that there are no in-scope high-strength steel closure bolting exposed to air with steam or water leakage in the auxiliary systems and, therefore, finds the applicant's determination acceptable.

In LRA Table 3.3-1, line item 3.3.1-36 addresses Boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated water. The GALL Report recommends the use of GALL AMP XI.M22, "Boraflex Monitoring Program," to manage the reduction in neutron-absorbing capacity for this component group. The applicant stated that this line item is not applicable because the applicant does not have Boraflex spent fuel storage racks neutron-absorbing sheets. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that the applicant's LRA does not have any AMR results for the auxiliary systems that include Boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated water. The staff also noted that a search of the applicant's UFSAR did not find any evidence of Boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated water in the auxiliary systems. Based on its review of the LRA and UFSAR, the staff confirmed that there are no in-scope Boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated water in the auxiliary systems and, therefore, finds the applicant's determination acceptable.

In LRA Table 3.3-1, line item 3.3.1-38 addresses stainless steel piping, piping components, and piping elements exposed to treated water at greater than 60 °C. The GALL Report recommends the use of GALL AMP XI.M7, "BWR Stress Corrosion Cracking," and GALL AMP XI.M2, "Water Chemistry," to manage cracking due to SCC for this component group. The applicant stated that this line item is not applicable because the applicant does not have any stainless steel piping, piping components, and piping elements exposed to treated water at greater than 60 °C in the auxiliary systems. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that the applicant's LRA does not have any AMR results for the auxiliary systems that include stainless steel piping, piping components, and piping elements exposed to treated water at greater than 60 °C. The staff also noted that a search of the applicant's UFSAR did not find any evidence of stainless steel piping, piping components, and piping elements exposed to treated water at greater than 60 °C in the auxiliary systems. Based on its review of the LRA and UFSAR, the staff confirmed that there are no in-scope stainless steel piping, piping components, and piping elements exposed to treated water at greater than 60 °C in the auxiliary systems and, therefore, finds the applicant's determination acceptable.

In LRA Table 3.3-1, line item 3.3.1-39 addresses stainless steel BWR spent fuel storage racks exposed to treated water at greater than 60 °C. The GALL Report recommends the use of GALL AMP XI.M2, "Water Chemistry," to manage cracking due to SCC for this component group. The applicant stated that this line item is not applicable because the applicant does not have any stainless steel BWR spent fuel storage racks exposed to treated water at greater than 60 °C. The staff reviewed LRA Sections 2.3.3 and 3.3 and noted that the applicant's LRA included one AMR result for stainless steel BWR spent fuel storage racks exposed to treated water. The staff noted that the item was not for treated water at greater than 60 °C, as is used in the SRP-LR for item 3.3.1-39. The staff also noted that a search of the applicant's UFSAR did not find any evidence of stainless steel BWR spent fuel storage racks exposed to treated water at greater than 60 °C in the auxiliary systems. Based on its review of the LRA and UFSAR, the staff confirmed that there are no in-scope stainless steel BWR spent fuel storage racks exposed to treated water at greater than 60 °C and, therefore, finds the applicant's determination acceptable.

In LRA Table 3.3-1, line item 3.3.1-40 addresses steel fuel oil tanks exposed externally to outdoor air. The GALL Report recommends the use of GALL AMP XI.M29, "Aboveground Steel

Tanks,” to manage loss of material due to general, pitting, and crevice corrosion for this component group. The applicant stated that this line item is not applicable because it does not have any steel fuel oil tanks exposed externally to outdoor air in the auxiliary systems. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that the applicant’s LRA does not have any AMR results for the auxiliary systems that include steel fuel oil tanks exposed externally to outdoor air. The staff also noted that a search of the applicant’s UFSAR did not find any evidence of steel fuel oil tanks exposed to outdoor air in the auxiliary systems. Based on its review of the LRA and UFSAR the staff confirmed that there are no in-scope steel fuel oil tanks exposed externally to outdoor air in the auxiliary systems and, therefore, finds the applicant’s determination acceptable.

In LRA Table 3.3-1, line item 3.3.1-41 addresses high-strength steel closure bolting exposed to air with steam or water leakage. The GALL Report recommends the use of GALL AMP XI.M18, “Bolting Integrity,” to manage cracking due to cyclic loading or SCC for this component group. The applicant stated that this line item is not applicable because high-strength steel bolting is not used in the auxiliary systems. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that the applicant’s LRA does not have any AMR results for the auxiliary systems that include high-strength steel closure bolting exposed to air with steam or water leakage. The staff also noted that a search of the Audit Report did not find any evidence of high-strength steel closure bolting exposed to air with steam or water leakage in the auxiliary systems. Based on its review of the LRA and audit interviews, the staff confirmed that there are no in-scope high-strength steel closure bolting exposed to air with steam or water leakage in the auxiliary systems and, therefore, finds the applicant’s determination acceptable.

In LRA Table 3.3-1, line item 3.3.1-42 addresses steel closure bolting exposed to air with steam or water leakage. The GALL Report recommends the use of GALL AMP XI.M18, “Bolting Integrity,” to manage loss of material due to general corrosion for this component group. The applicant stated that this line item is not used because steel bolting in the auxiliary systems is managed under line item 3.3.1-43 for steel closure bolting exposed to indoor uncontrolled air. The staff noted that the GALL Report also recommends the use of GALL AMP XI.M18, “Bolting Integrity,” to manage loss of material due to general corrosion for line item 3.3.1-43. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that the applicant’s LRA does not have any AMR results for the auxiliary systems that include steel closure bolting exposed to air with steam or water leakage. Since the component, material, aging effect, and AMP recommended by the GALL Report for item 3.3.1-42 are also included in item 3.3.1-43, the staff finds it acceptable for the applicant to include evaluations associated with item 3.3.1-42 in the evaluations performed for item 3.3.1-43 and to designate item 3.3.1-42 as not used.

In LRA Table 3.3-1, line item 3.3.1-43 addresses steel bolting and closure bolting exposed externally to indoor uncontrolled or outdoor air. The GALL Report recommends the use of GALL AMP XI.M18, “Bolting Integrity,” to manage loss of material due to general, pitting, and crevice corrosion for this component group. The applicant stated that the aging effect of loss of material due to pitting and crevice corrosion is not applicable because the indoor uncontrolled air environment is not aggressive and does not contain a high concentration of contaminants. The applicant also stated that the Bolting Integrity Program is used to manage the effects of loss of material due to general corrosion for steel bolting and closure bolting exposed to indoor uncontrolled air in auxiliary systems. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that the applicant’s LRA does not have any AMR results for the auxiliary systems that include steel bolting and closure bolting exposed externally to indoor uncontrolled air with an aging effect of loss of material due to pitting and crevice corrosion. The staff reviewed the Audit Report and UFSAR and did not find any indication that the applicant’s indoor uncontrolled air is an aggressive or highly contaminated environment. Based on its review of the LRA, Audit Report, and UFSAR, the staff confirmed that the applicant's indoor air does not promote an environment conducive to loss of material due to pitting and crevice corrosion and, therefore, the staff finds the applicant's determination acceptable.

In LRA Table 3.3-1, line item 3.3.1-44 addresses steel compressed air system closure bolting exposed to condensation. The GALL Report recommends the use of GALL AMP XI.M18, "Bolting Integrity," to manage loss of material due to general, pitting, and crevice corrosion for this component group. The applicant stated that this line item is not applicable because the applicant does not have any steel compressed air system closure bolting exposed to condensation in the auxiliary systems. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that the applicant's LRA does not have any AMR results for the auxiliary systems that include steel compressed air system closure bolting exposed to condensation. The staff also noted that a search of the Audit Report and the applicant's UFSAR did not find any evidence of steel compressed air system closure bolting exposed to condensation in the auxiliary systems. Based on its review of the LRA, Audit Report, and UFSAR, the staff confirmed that there are no in-scope steel compressed air system closure bolting exposed to condensation in the auxiliary systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.3-1, line item 3.3.1-49 addresses stainless steel or steel with stainless steel cladding heat exchanger components exposed to closed cycle cooling water. The GALL Report recommends use of GALL AMP XI.M21 "Closed-Cycle Cooling Water System" Program to manage loss of material due to microbiologically influenced corrosion (MIC) for this component group. The applicant stated that this line item is not applicable because the applicant does not have any plant specific operating experience that supports MIC in their closed cooling water environment. The staff noted that having no operating experience indicating a problem with MIC in a closed-cycle cooling water system that is controlled by a water chemistry program may only be a result of acceptable control of water chemistry parameters in the past, and does not preclude the aging effect from occurring in the future. By email dated March 22, 2010, the staff requested that the applicant provide additional justification for why loss of material due to MIC for stainless steel and steel with stainless steel cladding heat exchanger components exposed to closed cycle cooling water is not being managed in accordance with the Closed Cycle Cooling Water Program as recommended by the GALL Report.

In its response dated April 2, 2010, the applicant stated that further review determined that it has no stainless steel or steel with stainless steel cladding heat exchanger components exposed to closed cycle cooling water that are in the scope of license renewal. As a result, the applicant revised line item 3.3.1-49 to indicate that the item is not applicable because it has no in scope components, revised the hydrogen water chemistry system description in LRA Section 3.3.1.14 to include copper alloy as a material, added an item to LRA Table 3.3.2-14 for copper alloy heat exchanger components exposed externally to indoor uncontrolled air, revised the item in LRA Table 3.3.2-14 previously for stainless steel heat exchanger components exposed to closed-cycle cooling water to be for copper alloy heat exchanger components, and deleted the item in LRA Table 3.3.2-24 for stainless steel heat exchanger components exposed to closed-cycle cooling water.

The staff reviewed LRA 2.3.3 and 3.3 for the deleted item in LRA Table 3.3.2-24 and confirmed that the applicant's LRA, after revision based on the applicant's response, does not have any AMR results for the reactor water cleanup system that include stainless steel heat exchangers, condensers, coolers, or fan coils exposed to closed-cycle cooling water. The staff reviewed the applicant's UFSAR and confirmed that no in-scope stainless steel heat exchangers, condensers, coolers, or fan coils exposed to closed-cycle cooling water are present in the reactor water cleanup system and, therefore, finds the applicant's determination acceptable. The item in LRA Table 3.3.2-14 that was revised to address copper alloy heat exchanger components exposed to closed-cycle cooling water using the Closed-Cycle Cooling Water Program cited generic note B, indicating that the aging management program used is consistent with but takes some exceptions to the GALL Report program. The item that was added to LRA Table 3.3.2-14 for copper alloy heat exchanger components exposed externally to indoor uncontrolled air cited generic note C, indicating that the component is different but the item is consistent with the GALL Report. The component noted by the applicant is heat exchangers, condensers, coolers, and fan coils; while the GALL Report references stainless steel, copper alloy, and nickel alloy piping, piping components, and piping elements exposed externally to indoor uncontrolled air in line item 3.4.1-41. The staff finds the aging management program proposed by the applicant for this component acceptable because copper alloy external heat exchanger components will experience the same aging effects as copper alloy external piping components in an uncontrolled air environment.

The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that the applicant's LRA, after revision as documented above, does not have any AMR results for the auxiliary systems that include stainless steel or steel with stainless steel cladding heat exchanger components exposed to closed cycle cooling water. The staff noted that a search of the applicant's UFSAR did not find any evidence of stainless steel with stainless steel cladding heat exchanger components exposed to closed cycle cooling water in the auxiliary systems. Based on its review of the LRA and UFSAR, the staff confirmed that there are no in-scope stainless steel or steel with stainless steel cladding heat exchanger components exposed to closed cycle cooling water in the auxiliary systems and, therefore, finds the applicant's determination acceptable. The staff's concerned described above is resolved.

In LRA Table 3.3-1, line item 3.3.1-59 addresses steel heat exchanger components exposed externally to indoor uncontrolled or outdoor air. The GALL Report recommends the use of GALL AMP XI.M36, "External Surfaces Monitoring," to manage loss of material due to general, pitting, and crevice corrosion for this component group. The applicant stated that this line item is not applicable for steel heat exchanger components exposed externally to outdoor air because the applicant has no steel heat exchangers exposed externally to outdoor air in the auxiliary systems. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that the applicant's LRA does not have any AMR results for the auxiliary systems that include steel heat exchanger components exposed externally to indoor uncontrolled air. The staff also noted that a search of the applicant's UFSAR did not find any evidence of steel heat exchanger components exposed externally to outdoor air in the auxiliary systems.

The applicant stated that the aging mechanism of loss of material due to pitting and crevice corrosion is not applicable because the indoor uncontrolled air environment is not aggressive and does not contain a high concentration of contaminants. The applicant also stated that the line item is only applicable for the aging mechanism of loss of material due to general corrosion for steel heat exchanger components externally exposed to indoor uncontrolled air. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that the applicant's LRA does not have any AMR results for the auxiliary systems that include steel heat exchanger components exposed externally to indoor uncontrolled air with an aging mechanism of loss of material due to pitting and crevice corrosion. The staff also reviewed LRA Section 3.3 and confirmed that the applicant's LRA does have an AMR result for the auxiliary systems that includes steel heat exchanger components exposed externally to indoor uncontrolled air with an aging mechanism of loss of material due to corrosion. The staff reviewed the Audit Report and UFSAR and did not find any indication that the applicant's indoor uncontrolled air is an aggressive or highly contaminated environment. Based on its review of the LRA and UFSAR, the staff confirmed that there are no in-scope steel heat exchanger components exposed externally to outdoor air in the auxiliary systems and that the applicant's indoor air does not promote an environment conducive to loss of material due to pitting and crevice corrosion and, therefore, finds the applicant's determination acceptable.

In LRA Table 3.3-1, line item 3.3.1-62 addresses aluminum piping, piping components, and piping elements exposed to raw water. The GALL Report recommends use of GALL AMP XI.M26 "Fire Protection Program" to manage loss of material due to general, pitting, and crevice corrosion for this component group. The applicant stated that this line item is not applicable because applicant does not have any aluminum piping, piping components, and piping elements exposed to raw water in the auxiliary systems. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that the applicant's LRA does not have any AMR results for the auxiliary systems that include aluminum piping, piping components, and piping elements exposed to raw water. The staff also noted that a search of the applicant's UFSAR did not find any evidence of aluminum piping, piping components, and piping elements exposed to raw water in the auxiliary systems. Based on its review of the LRA and UFSAR, the staff confirmed that there are no in-scope aluminum piping, piping components, and piping elements exposed to raw water in the auxiliary systems and, therefore, finds the applicant's determination acceptable.

In LRA Table 3.3-1, line item 3.3.1-63 addresses steel fire-rated doors exposed to indoor uncontrolled or outdoor air. The GALL Report recommends the use of GALL AMP XI.M26, "Fire Protection," to manage loss of material due to wear for this component group. The applicant stated that this line item is not applicable because the applicant does not have any steel fire-rated doors exposed to outdoor air and that the steel fire-rated doors exposed to indoor uncontrolled air discussed in LRA Section 3.5 are for containment, structures, and component supports. The staff reviewed LRA Section 3.5 and confirmed that steel fire-rated doors are included in that section and they are managed for the effects of aging with the Fire Protection Program. The staff also reviewed LRA Sections 2.3.3 and 3.3 and confirmed that the applicant's LRA does not have any AMR results for the auxiliary systems that include steel fire-rated doors exposed to indoor uncontrolled or outdoor air. The staff noted that a search of the applicant's UFSAR did not find any evidence of steel fire-rated doors exposed to outdoor air in the auxiliary systems. Based on its review of the LRA and UFSAR, the staff confirmed that there are no in-scope steel fire-rated doors exposed to indoor uncontrolled or outdoor air in the auxiliary systems and, therefore, finds the applicant's determination acceptable.

In LRA Table 3.3-1, line item 3.3.1-75 addresses elastomer seals and components exposed to raw water. The GALL Report recommends the use of GALL AMP XI.M20, "Open-Cycle Cooling Water System," to manage hardening and loss of strength due to elastomer degradation or loss of material due to erosion for this component group. The applicant stated that this line item is not applicable because the applicant has no elastomers exposed to raw water that are not periodically replaced. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that the applicant's LRA does not have any AMR results for the auxiliary systems that include elastomer seals and components exposed to raw water. The staff also noted that a search of the applicant's UFSAR did not find any evidence of elastomer seals and components exposed to raw water in the auxiliary systems. Based on its review of the LRA and UFSAR, the staff confirmed that there are no in-scope elastomer seals and components exposed to raw water in the auxiliary systems and, therefore, finds the applicant's determination acceptable.

In LRA Table 3.3-1, line item 3.3.1-96 addresses steel or stainless steel piping, piping components, and piping elements exposed to concrete. The GALL Report recommends no AMP for this component group and has no aging effect or mechanism listed. The applicant stated that this line item is not applicable because the applicant does not have any steel or stainless steel piping, piping components, and piping elements exposed to concrete in the auxiliary systems. The staff reviewed LRA Sections 2.3.3 and 3.3 and confirmed that the applicant's LRA does not have any AMR results for the auxiliary systems that include steel or stainless steel piping, piping components, and piping elements exposed to concrete. The staff also noted that a search of the applicant's UFSAR did not find any evidence of steel or stainless steel piping, piping components, and piping elements exposed to concrete in the auxiliary systems. Based on its review of the LRA and UFSAR, the staff confirmed that there are no in-scope steel or stainless steel piping, piping components, and piping elements exposed to concrete in the auxiliary systems and, therefore, finds the applicant's determination acceptable.

3.3.2.1.2 Loss Of Material Due to Pitting and Crevice Corrosion

LRA Table 3.3-1, item 3.3.1-27 addresses loss of material due to pitting and crevice corrosion for stainless steel HVAC ducting and aluminum HVAC piping, piping components, and piping elements exposed to condensation.

The LRA credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and the Compressed Air Monitoring Program to manage this aging effect for stainless steel and aluminum alloy components in a condensation (internal) type environment. The GALL Report recommends that a plant–specific AMP be used to manage this aging effect. The LRA AMR line items that reference line item 27 in GALL Report Table 3 cite generic note E, indicating that the AMR line items are consistent with the GALL Report for material, environment, and aging effect, but a different AMP is credited.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and Compressed Air Monitoring Program and its evaluation is documented in SER Sections 3.0.3.1.20 and 3.0.3.1.14, respectively. The staff noted that the applicant credited GALL Report AMR item VII.F2-1, in LRA Tables 3.3.2-17 and 3.3.2-23, for item 3.3.1-27. The staff also noted that the applicant credited AMR item VII.F2-12 in LRA Table 3.3.2-27 for item 3.3.1-27 and also AMR item VII.F4-10 in LRA Table 3.3.2-29 for item 3.3.1-27. The staff finds that the applicant's use of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and the Compressed Air Monitoring Program is acceptable because the applicant indicated that these programs will use visual inspections, which are appropriate to manage this type of aging effect.

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).

3.3.2.1.3 Cracking Due to Stress Corrosion Cracking

LRA Table 3.3-1, item 3.3.1-46 addresses cracking due to SCC of stainless steel and stainless steel clad steel piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water greater than 60 °C (greater than 140 °F).

The LRA credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage this aging effect for stainless steel and stainless steel clad steel piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water greater than 60 °C (greater than 140 °F). The GALL Report recommends the Closed-Cycle Cooling Water System Program to manage this aging effect. The AMR line item in Table 3.3.2-6 that references GALL Report Table 3, item 46, cites generic note E, indicating that the AMR line item is consistent with the GALL Report material, environment, and aging effect, but a different AMP is credited.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.20 . The staff reviewed the applicant's AMR line items associated with item 3.3.1-46 and noted that the applicant credited GALL Report AMR item VII.C2-11 in LRA Table 3.3.2-6 for item 3.3.1-46. The GALL Report recommends using the Closed-Cycle Cooling Water System Program to manage this aging effect. The staff finds that the applicant's use of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is acceptable because it contains inspections that will be capable of detecting and evaluating SCC.

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).

3.3.2.1.4 Loss of Material Due to General, Pitting, Crevice, and Galvanic Corrosion

LRA Table 3.3-1, item 3.3.1-48 addresses loss of material due to general, pitting, crevice, and galvanic corrosion of steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to closed-cycle cooling water.

The applicant credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage this aging effect for cast iron heat exchanger, condenser, cooler, fan, and coil components exposed to closed-cycle cooling water. The GALL Report recommends using the Closed-Cycle Cooling Water System Program to manage this aging effect. The AMR line item that references GALL Report Table 3, item 48, cites generic note E, indicating that the AMR line item is consistent with the GALL Report material, environment, and aging effect, but a different AMP is credited.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.20 . The staff reviewed the applicant's AMR line items associated with item 3.3.1-48 and noted that for one item, the applicant credited GALL Report AMR item VII.C2-1, in LRA Table 3.3.2-11 for item 3.3.1-48. The staff finds that the applicant's use of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is acceptable because it uses visual inspection, which is adequate to monitor for the effects of loss of material.

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).

3.3.2.1.5 Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.3-1, item 3.3.1-50 addresses loss of material due to pitting and crevice corrosion of stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water.

The applicant credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage this aging effect for stainless steel instrumentation, transmitter/element exposed to closed-cycle cooling water. The GALL Report recommends using the Closed-Cycle Cooling Water System Program to manage this aging effect. The AMR line item in Table 3.3.2-6 that references GALL Report Table 3, item 50, cites generic note E, indicating that the AMR line item is consistent with the GALL Report material, environment, and aging effect, but a different AMP is credited.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.20. The staff reviewed the applicant's AMR line items associated with item 3.3.1-50 and noted that for one item, the applicant credited GALL Report AMR item VII.C2-10, in LRA Table 3.3.2-6 for item 3.3.1-50. The GALL Report recommends using the Closed-Cycle Cooling Water System Program to manage this aging effect. The staff finds that the applicant's use of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is acceptable because it contains inspections that will be capable of detecting and evaluating loss of material.

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).

3.3.2.1.6 Loss of Material Due to Pitting, Crevice, and Galvanic Corrosion

LRA Table 3.3-1, item 3.3.1-51 addresses loss of material due to pitting, crevice, and galvanic corrosion of copper alloy piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water.

The applicant credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components to manage this aging effect for admiralty brass heat exchanger, condenser, cooler, and fan coil exposed to closed-cycle cooling water. The GALL Report recommends using the Closed-Cycle Cooling Water System Program to manage this aging effect. The AMR line items in Table 3.3.2-11 that reference GALL Report Table 3, item 51, cite generic note E, indicating that the AMR line item is consistent with the GALL Report material, environment, and aging effect, but a different AMP is credited.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.20. The staff reviewed the applicant's AMR line items associated with item 3.3.1-51 and noted that for two items, the applicant credited GALL Report AMR item VII.C2-4, in LRA Table 3.3.2-11 for item 3.3.1-51. The applicant's use of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is acceptable because it contains inspections that will be capable of detecting and evaluating loss of material.

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).

3.3.2.1.7 Reduction of Heat Transfer Due to Fouling

LRA Table 3.3-1, item 3.3.1-52 addresses reduction in heat transfer due to fouling of steel, stainless steel, and copper alloy heat exchanger exposed to closed-cycle cooling water.

The applicant credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage this aging effect for copper alloy heat exchanger exposed to closed-cycle cooling water. The GALL Report recommends using the Closed-Cycle Cooling Water System Program to manage this aging effect. The AMR line items that reference GALL Report Table 3, item 52, cite generic note E, indicating that the AMR line item is consistent with the GALL Report material, environment, and aging effect, but a different AMP is credited.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.20. The staff reviewed the applicant's AMR line items associated with item 3.3.1-52 and noted that the applicant credits GALL Report AMR item VII.C2-2, in LRA Table 3.3.2-11 for item 3.3.1-52 and also credits GALL Report AMR item VII.F2-10, in LRA Table 3.3.2-23 for item 3.3.1-52. The applicant's use of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is acceptable because it contains inspections that will be capable of detecting and evaluating reduction in heat transfer.

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).

3.3.2.1.8 Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.3-1, item 3.3.1-54 addresses loss of material due to pitting and crevice corrosion in the stainless steel piping, piping components, and piping elements. The applicant stated that the component type of the AMR item in LRA Table 3.3.2-27 is "heat exchanger, condenser, cooler, fan coil" and the component types of the AMR items in LRA Table 3.3.2-29 are "filter, screens, strainer, pipe, pipe fittings, hoses, tubes, rupture disk" and "Valve, damper." The applicant further claimed that the consistency note for the AMR items is note E, which means that the material, environment, and aging effect are consistent with the GALL Report, but a different AMP is credited. In the LRA, the applicant credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, where the GALL Report recommends GALL AMP XI.M24, "Compressed Air Monitoring." The staff reviewed the AMR items in comparison with the SRP-LR Table 3.3-1, item 54 and GALL Report Volume 2, item VII.D-4.

By letter dated November 13, 2009, the staff issued RAI 3.3.2.1.x-1 requesting that the applicant clarify why the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is credited for the AMR items in lieu of the Compressed Air Monitoring Program that is recommended by the GALL Report and provide justification why the credited program can adequately manage the loss of material due to pitting and crevice corrosion for the AMR items.

In its response dated December 14, 2009, the applicant stated the items of concern are the stainless steel components in the starting air systems for the standby diesel generator (SBDG) system. The applicant stated that the air operated instrumentation associated with the SBDGs is supplied by the plant instrument air system and is managed by the Compressed Air Program, which applies to maintaining the air quality of the instrument air systems. In comparison, each SBDG has its own starting air system, which is only associated with the diesel generator. The applicant further stated that much of the piping and several valves in the diesel starting air systems are made from carbon steel and align well with GALL AMR item VII.H2-21, which recommends the Inspection of the Internal Surfaces of Miscellaneous Piping and Ducting Components Program for these components. However, the applicant stated that the starting air systems also contain stainless steel components and GALL Report Table VII.H2 does not contain a line item for components of stainless steel with the correct combination of environment, aging effect, and AMP. Therefore, as an alternative for these stainless steel components, GALL AMR item VII.D-4 was referenced because it had correct material and environment. The applicant stated that the Inspection of the Internal Surfaces of Miscellaneous Piping and Ducting Components Program will manage the SBDG starting air components and the Compressed Air Program will monitor the instrument air components. The Inspection of the Internal Surfaces of Miscellaneous Piping and Ducting Components Program performs visual inspections of internal surfaces of plant components to manage effects of loss of material, heat transfer degradation, fouling, and cracking. The applicant further stated that procedural requirements exist to blow-down the diesel start air receivers once per day to remove any accumulated moisture and this minimizes corrosion products in the system should any moisture be present in the receivers and the system also has an air start filter installed to remove foreign matter if present. The applicant has not identified operating experience that specifically relates to failures or problems associated with air quality in the SBDG starting air system. The staff's review of the Inspection of the Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.20.

Based on its review, the staff finds the applicant's response to RAI 3.3.2.1.x-1 acceptable because the applicant clarified that: (1) the Inspection of the Internal Surfaces of Miscellaneous Piping and Ducting Components Program performs visual inspections that can detect and manage loss of material in the components, (2) its operating experience with the SBDG starting air systems has not indicated a failure or problem associated with air quality in the systems, (3) its procedural requirements for the blow-down operations can remove accumulated moisture from the air receivers, and (4) the Compressed Air Program manages loss of material in the components of the instrument air systems. The staff's concern described in RAI 3.3.2.1.x-1 is resolved.

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).

3.3.2.1.9 Loss of Material Due to General Corrosion

In LRA Table 3.5.2-3, the applicant references GALL Report line item VII.B-3 and note E, and credits the Structures Monitoring Program for managing loss of material for carbon steel in an air – indoor uncontrolled environment.

The staff reviewed the AMR results that reference note E and determined that the component type, material, and aging effects are consistent with the corresponding line of the GALL Report;

however, the GALL Report recommends GALL AMP XI.M23, “Inspection of Overhead Handling Systems.” The staff noted that the LRA also credits the GALL Report recommended AMP for these line items. The staff’s review of the Overhead Handling Systems Program is documented in SER Section 3.0.3.2.7. Since the applicant is using the Structures Monitoring Program in addition to the GALL Report recommended program, the staff finds these AMR results to be acceptable.

In LRA Table 3.5.2-5, for component type “diesel generator fuel tank wire rope below grade,” the applicant references GALL Report line item III.A3.12 and note E, and credits the Buried Piping and Tanks Inspection Program for managing loss of material/corrosion in a soil (external) environment.

The staff reviewed the AMR results discussed above and determined, for these items, that the component type, material, and aging effect are consistent with the corresponding line of the GALL Report; however, the GALL Report lists the environment as air-indoor uncontrolled or air-outdoor and not as soil (external). Also the GALL Report recommends GALL AMP XI.S6, “Structures Monitoring Program,” and the applicant has proposed using the Buried Piping and Tanks Inspection Program. The applicant stated that the Buried Piping and Tanks Inspection Program includes provisions for visual inspections of buried steel components, such as piping and tanks, and that visual inspections of the protective wraps and coatings on buried carbon steel, piping, and tanks in-scope for license renewal are performed when the carbon, low-alloy, and stainless steel tanks are excavated and exposed for any reason and addresses loss of material due to general, pitting, and crevice corrosion and MIC. Although the buried steel components are not routinely uncovered during maintenance activities, the applicant stated that the Buried Piping and Tanks Inspection Program requires that at least one opportunistic or focused inspection be performed prior to entering the period of extended operation with additional inspections performed at least once every 10 years thereafter. The GALL Report Structural Monitoring Program also uses visual inspections, but does not require removal of material to expose inaccessible areas for inspection unless there are indications of degradation in representative accessible areas or environmental conditions are favorable for degradation. The staff finds that the Buried Piping and Tanks Inspection Program provides an enhancement relative to the GALL AMP XI.S6 for this AERM. In addition, this line item corresponds closely with GALL Table VII, item A-01 that addresses loss of material/general, pitting, and crevice corrosion and MIC and identifies GALL AMP XI.M34, “Buried Piping and Tanks Inspection,” as the correct AMP. The Buried Piping and Tanks Inspection Program is a new program that is consistent with GALL AMP XI.M34. Since the applicant has committed to an appropriate AMP for the period of extended operation, the staff finds these AMR results to be acceptable.

In LRA Table 3.5.2-7, for component type “torus downcomer,” the applicant references GALL Report line item II.B1.1-2 and note E, and credits the Water Chemistry Program for managing this aging effect/mechanism for carbon steel in a treated water environment.

The staff reviewed the AMR results discussed above and determined that the component type, material, and aging effects are consistent with the corresponding line of the GALL Report; however, the GALL Report recommends GALL AMP XI.S1, “ASME Section XI, Subsection IWE.” The staff noted that the LRA also credits the GALL Report recommended AMP for these line items. The staff’s review of the ASME Section XI Inservice Inspection, IWE Program is documented in SER Section 3.0.3.1.4. Since the applicant is using the Water Chemistry Program in addition to the GALL Report recommended program, the staff finds these AMR results to be acceptable.

In LRA Table 3.5.2-7, for component type “torus structural steel,” the applicant references GALL Report line item II.B1.1-2 and note E, and credits the Structures Monitoring Program for managing loss of material for carbon steel in a treated water environment.

The staff reviewed the AMR results discussed above and determined that the component type, material, and aging effects are consistent with the corresponding line of the GALL Report; however, the GALL Report recommends GALL AMP XI.S1, “ASME Section XI, Subsection IWE.” The staff is not clear how the Structures Monitoring Program meets the recommendations of the suggested GALL Report AMP; therefore, by letter dated November 13, 2009, the staff issued RAI 3.5.2.1-2 asking the applicant to explain how the Structures Monitoring Program would meet or exceed the recommendations of GALL AMP XI.S1.

In its response dated December 14, 2009, the applicant stated that the staff request relates to LRA Table 3.5.2-7 line item, “Torus Structural Steel,” on page 3.5-86. Torus structural steel is the structural steel associated with ladders and walkways within the torus. These items are not part of the containment structure managed by ASME Section XI, Subsection IWE and, therefore, the ASME Section XI Inservice Inspection, IWE Program is not applicable. Due to the high humidity in the torus, the structural steel supporting the ladders and walkways will be inspected on a 5-year interval. The visual inspections will be conducted under the Structures Monitoring Program by qualified personnel possessing expertise in the design and inspection of steel structures.

Since the applicant has committed to the appropriate AMP to manage torus structural steel supports inside the torus, not associated with the containment pressure boundary, the staff finds the response acceptable. The staff finds that the applicant appropriately addressed the aging effect or mechanism for the period of extended operation. The staff’s concern described in RAI 3.5.2.1-2 is resolved.

In LRA Table 3.5.2-8, the applicant references GALL Report line item VII.G-3 and note E, and credits the Structures Monitoring Program for managing loss of material for carbon steel in an air-indoor uncontrolled environment.

The staff reviewed the AMR results that reference note E and determined that the component type, material, and aging effects are consistent with the corresponding line of the GALL Report; however, the GALL Report recommends GALL AMP XI.M26, “Fire Protection.” The staff noted that the LRA also credits the GALL Report recommended AMP for these line items. The staff’s review of the Fire Protection Program is documented in SER Section 3.0.3.2.4. Since the applicant is using the Structures Monitoring Program in addition to the GALL Report recommended program, the staff finds these AMR results to be acceptable.

In LRA Table 3.5.2-8, for component type “watertight (submarine) door,” the applicant references GALL Report line item III.A3.12 and note E, and credits the Fire Protection Program for managing loss of material in an air-indoor uncontrolled environment.

The staff reviewed the AMR results lines discussed above and determined, for these items, that the component type, material, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends GALL AMP XI.S6, “Structures Monitoring Program,” the applicant has proposed using the Fire Protection Program. The LRA states that the watertight (submarine) door has intended functions of fire barrier and flood barrier. In the Structures Monitoring Program basis documents, reviewed during the onsite audit, the applicant stated that although the Structures Monitoring Program is considered the primary program applicable to aging management of structural elements and doors, examinations are also conducted under the Fire Protection Program to provide an added degree of assurance that age-related deterioration of fire barrier structural elements and doors is detected in a timely manner. Since the applicant stated that it uses the Structures Monitoring Program as the primary AMP, the staff finds the applicant's additional use of the Fire Protection Program acceptable. Since the applicant has committed to an appropriate AMP for the period of extended operation, the staff finds these AMR results to be acceptable.

In LRA Table 3.5.2-9, for component type "fuel pool and components," the applicant references GALL Report line item III.B1.1-11 and note E, and credits the Structures Monitoring Program for managing loss of material/general, pitting, and crevice corrosion of stainless steel in a treated water environment.

The staff reviewed the AMR discussed above and determined, for these items, that the material and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends GALL AMP XI.M2, "Water Chemistry," the applicant has proposed using the Structures Monitoring Program. The staff noted that the LRA also credits the GALL Report recommended Water Chemistry Program for these line items. The staff's review of the Water Chemistry Program is documented in SER Section 3.0.3.1.26. Since the applicant is using the Structures Monitoring Program in addition to the GALL Report recommended program, the staff finds these AMR results to be acceptable.

In LRA Table 3.5.2-10, for component type "ASME Class MC Supports," the applicant references GALL Report line item II.B1.1-2 and note E, and credits the ASME Section XI, Subsection IWF Program for managing loss of material for carbon steel in a treated water (external) environment.

The staff reviewed the AMR results discussed above and determined that the component type, material, and aging effects are consistent with the corresponding line of the GALL Report; however, the GALL Report recommends GALL AMP XI.S1, "ASME Section XI, Subsection IWE." The staff noted that the referenced component types are not a part of the containment pressure boundary; therefore, the use of the ASME Section XI Inservice Inspection, IWE Program is not necessary. Since the supports are not part of the pressure boundary, the staff finds the use of the ASME Section XI, Inservice Inspection IWF Program acceptable.

In LRA Table 3.5.2-10, for component type "defective fuel storage container," the applicant references GALL Report line item VII.A2-1 and note E and C, and credits the ASME Section XI, Inservice Inspection IWF and Water Chemistry Programs respectively for managing loss of material of stainless steel in a treated water environment. The staff is not clear on how the selected AMPs are sufficient to manage aging of the "defective fuel storage container;" therefore, by letter dated November 13, 2009, the staff issued RAI 3.5.2.1-a requesting the applicant to explain how the AMPs will manage aging of this component during the period of extended operation.

In its response dated December 14, 2009, the applicant stated that the defective fuel storage container is a tool that is used to store defective fuel until a proper disposition can be accomplished and the normal environment is air-indoor uncontrolled, however, when submerged, it has an environment of treated water less than 140F. The applicant revised LRA Table 3.5.2-10, line item 3.5.1-49 by deleting the line item for managing the aging effect with the ASME Section XI, Inservice Inspection IWF Program and changed the GALL Report reference to TP-10. The staff reviewed this response and noted that the applicant in deleting the ASME

Section XI, Inservice Inspection IWF Program should have added a line item that would have included a program that could confirm the effectiveness of the Water Chemistry Program given that the SRP-LR recommends the Water Chemistry and ISI(IWF) Programs. This issue was forwarded to the applicant by an e-mail dated March 17, 2010. In its response dated April 2, 2010, the applicant stated that they had revised Table 3.5.2-10, line item 3.5.1-49 to include the One Time Inspection Program. The applicant also change the Table 1 line item reference to 3.3.1-24, GALL Report reference A-58 and cited note C. The staff finds the applicant's response acceptable because the spent fuel storage container will have the same aging effects as stainless steel piping exposed to treated water and the applicant has selected aging management programs that are consistent with the GALL Report. The staff's concern described in RAI 3.5.2.1-a is resolved.

In LRA Tables 3.5.2-1 through 3.5.2-11, for line items that reference Table 3.5-1, item 3.5.1-47 and note E, the applicant credits the Structures Monitoring Program for managing loss of material/general (steel only), pitting, and crevice corrosion resulting from exposure to raw water (external) or air-indoor uncontrolled (external).

The staff reviewed the AMR results discussed above and determined, for these items, that the component type, material, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends GALL 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. The applicant stated in the LRA and the staff confirmed in the program basis documents that the Structures Monitoring Program includes and is consistent with GALL AMP XI.S7. Since the Structures Monitoring Program includes GALL AMP XI.S7, and performs periodic visual inspections of carbon steel materials to detect loss of material/general, pitting, and crevice corrosion resulting from an air-indoor uncontrolled, air-outdoor, or water flowing or standing environment, the staff finds the applicant's use of the Structures Monitoring Program acceptable. Since the applicant has committed to an appropriate AMP for the period of extended operation, the staff finds these AMR results to be acceptable.

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).

3.3.2.1.10 Loss of Material Due to General Corrosion

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), in the reactor building, turbine building, and refueling platform crane rails.

The LRA credits the Structures Monitoring Program to manage this aging effect for carbon steel rails in an air-indoor uncontrolled (external) environment. The GALL Report recommends GALL AMP XI.M36, "External Surfaces Monitoring," to manage this aging effect. AMR line items in Table 3.5.2-3 that reference GALL Report Table 3, item 58, cite generic note E, indicating that the AMR line items are consistent with the GALL Report material, environment, and aging effect, but a different AMP is credited.

The staff noted that the applicant also credits the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program to manage loss of material due to wear for carbon steel rails in an air-indoor uncontrolled (external) environment.

The staff reviewed the Structures Monitoring Program and its evaluation is documented in SER Section 3.0.3.2.11. The staff noted that this program will include periodic visual inspections of associated structural components for the detection of aging effects specific to rails, such as loss of material. The staff also noted that the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program will manage loss of material due to general corrosion.

The staff confirmed that the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program supports management of aging effects due to general corrosion of crane and trolley structural components and wear on the rails in the rail system for those cranes that are within the scope of license renewal. The staff also noted that on a routine basis, the applicant, through visual inspections, will identify rail degradations due to corrosion and loss of material. In addition the staff confirmed that the Structures Monitoring Program can be used to monitor loss of material/corrosion for structural steel components in an air-indoor uncontrolled or air-outdoor environments.

In its response to RAIs B3.22-1 and B3.22-3 dated January 14, 2010, the applicant stated that the CARDOX system inspections would be performed under the Fire Protection Program. The applicant also revised LRA Table 3.3.2-11 for the fire protection system to include additional components. The applicant also revised the discussion column of item 3.3.1-58 to include the Fire Protection Program.

The staff compared the applicant's AMR results that are associated with LRA Table 3.3-1, item 3.3.1-58, with the AMR unique items in the GALL Report, Volume 1, Table 3, item 58.

The three AMR results (unique item) summarized in the GALL Report, Table 3, item 58 are items VII.I-8, VII.I-9, and VII.I-11 steel external surfaces exposed to air-indoor uncontrolled, air-outdoor, and condensation external environments with an aging effect of loss of material due to general corrosion. For these line items, the GALL Report recommends managing the aging effects with the External Surfaces Monitoring Program.

The staff noted that the applicant has used item VII.I-8 for component type accumulator, pulsation damper, low pressure tank, piping and fittings, rupture disk, and valve damper in LRA Table 3.3.2-11, fire protection system. The applicant credits its Fire Protection Program to manage the aging effect, and referenced footnote E, indicating that the AMR line items are consistent with the GALL Report material, environment, and aging effect, but a different AMP is credited.

The applicant stated that LRA Section B3.22, Fire Protection Program, is an existing program that manages aging effects for, but is not limited to, fire dampers, fire barrier walls, ceilings and floors, fire-rated penetration seals, diesel driven fire pump fuel oil supply line, fire doors, and carbon dioxide (CO_2) fire suppression system. The applicant also enhanced the program to state that its surveillance procedure for the CO_2 Cardox System Operability Annual Test will be revised to include a step to perform an inspection for corrosion and mechanical damage to system components. The staff noted that GALL AMP XI.M36, "External Surfaces Monitoring," recommends periodic visual inspections to detect corrosion. The staff finds the use of the Fire Protection Program acceptable because the applicant will perform periodic visual inspections of the Cardox system components to detect corrosion when performing the annual test and, therefore, is consistent with the recommendations of the GALL Report AMP.

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), in drip pans in the reactor building HVAC system.

The LRA credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage this aging effect for carbon steel drip pans in an air-indoor uncontrolled (external) environment. The GALL Report recommends GALL AMP XI.M36, “External Surfaces Monitoring,” to manage this aging effect. The AMR line item in Table 3.3.2-23 that references GALL Report Table 3, item 58, cites generic note E, indicating that the AMR line item is consistent with the GALL Report material, environment, and aging effect, but a different AMP is credited.

The staff reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.20. The staff noted that GALL AMP XI.M36 recommends visual opportunistic inspections to monitor internal surfaces of steel piping, piping elements, ducting, and components in an internal environment (air-indoor uncontrolled, condensation, and steam) that are not included in other AMPs, for loss of material. For drip pans, however, because the material is in an air-indoor uncontrolled (external) environment, the GALL Report recommends the use of GALL AMP XI.M36, “External Surfaces Monitoring Program.” Although the two programs employ visual inspections, the inspections in GALL AMP XI.M36 are bounded by time (at most during scheduled RFOs) while the inspections in GALL AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program,” are not. In addition, the staff noted that component materials depend on the environment, and take into consideration industry and plant-specific operating experience.

The staff noted that GALL AMP XI.M36 recommends a visual inspection to be performed at least once per refueling cycle while GALL AMP XI.M38 recommends that inspection intervals are dependent on component material and environment, and take into consideration industry and plant-specific operating experience. The staff noted that there is no stated frequency of inspections under the program proposed by the applicant and issued an RAI to determine the inspection frequency.

By letter dated November 13, 2009, the staff issued RAI B.3.3.2-23 requesting that the applicant provide the frequency of inspections for the drip pans and justify the frequency if it is different than the maximum frequency recommended by GALL AMP XI.M36.

In its response dated December 14, 2009, the applicant stated that the drip pans are constructed of galvanized carbon steel, have their “dry” side coated with insulation, and are totally enclosed within their cooling units The applicant also stated that annual condition-based inspections are performed on the cooling units and that if leakage, vibration, temperature variations, or other items of concern are identified, the units are then fully inspected which provides the opportunity to inspect the drip pans. The applicant stated that no plant-specific operating experience exists that points to degrading drip pans and that its condition-based approach to drip pan inspections will continue to be performed during extended operation under the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

Based on its review, the staff finds the applicant's response to the RAI acceptable because the condition-based inspections performed annually are adequate to identify loss of material due to general corrosion that may affect the drip pan's function. The staffs concern described in RAI B.3.3.2-23 is resolved.

The staff noted that since the drip pans are not accessible without opening the cooling units and have insulated external surfaces, that the External Surfaces Monitoring Program is not an appropriate AMP and the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is appropriate to manage aging of the drip pans.

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).

3.3.2.1.11 Increased Hardness, Shrinkage, and Loss of Strength Due to Weathering

In LRA Tables 3.5.2-1 through 3.5.2-11, for line items that reference Table 3.3-1, item 3.3.1-61, note E, the applicant credits the Structures Monitoring Program for managing increased hardness, shrinkage, and loss of strength due to weathering in an air-indoor uncontrolled (external) and atmosphere/weather (external) environment for elastomer materials having intended functions of fire barrier, flood barrier, structural pressure barrier, shielding, and structural support.

The staff reviewed the AMR results discussed above and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, GALL Report line items that address this AERM (VII.G-1 and VII.G-2) identify GALL AMP XI.M26, "Fire Protection." In program basis documents, reviewed during the onsite audit, the applicant stated that aging effects for non-fire protection sealants are managed by the Structures Monitoring Program and fire protection components are managed by the Fire Protection Program. The applicant stated that the Structures Monitoring Program is visual based, and uses guidance and criteria contained in ACI 349.3R that addresses waterproofing membranes for signs of separation, environmental degradation, or water leakage presence in joints or joint material. In the LRA, the applicant stated that the Fire Protection Program manages fire barrier penetration seals, and fire barrier walls, floors, and ceilings and has been enhanced to include criteria for visual inspections of fire barrier walls, ceilings, and floors. The staff's review of the Structures Monitoring Program and Fire Protection Program is documented in SER Sections 3.0.3.2.11 and 3.0.3.2.4 Since the applicant has committed to appropriate AMPs for the period of extended operation, the staff finds these AMR results to be acceptable.

LRA Table 3.3-1, item 3.3.1-61 addresses increased hardness, shrinkage, and loss of strength due to weathering in elastomer fire barrier penetration seals exposed to indoor or outdoor uncontrolled air.

The two AMR results (unique items) summarized in the GALL Report, Table 3, item 61 are:

(1) item VII.G-1, fire barrier penetration seals of elastomer material in an air-indoor uncontrolled environment with an aging effect of increased hardness, shrinkage, and loss of strength

(2) item VII.G-2, fire barrier penetration seals of elastomer material in an air-outdoor environment with an aging effect of increased hardness, shrinkage, and loss of strength

For each of these unique line items, the GALL Report recommends the Fire Protection Program to manage the aging effect.

The staff noted that the applicant stated in LRA Table 3.3.1, item 3.3.1-61 discussion column that increased hardness, shrinkage, and loss of strength of elastomer fire barrier penetration seals exposed to indoor and outdoor air is managed by the Fire Protection and the Structures Monitoring programs, and that this is addressed in Section 3.5. The staff noted that line item 3.3.1-61 is referenced in LRA Tables 3.5.2-8, 3.5.2-9, and 3.5.2-11.

The staff reviewed LRA Tables 3.5.2-8, 3.5.2-9, and 3.5.2-11 and noted that item 3.3.1-61 is referenced in eight line items in Table 3.5.2-8, twelve line items in Table 3.5.2-9, and four line items in Table 3.5.2-11; and that these lines reference GALL Report items VII.G-1 and VII.G-2. The staff noted that, for these line items, the applicant has credited the Fire Protection Program with footnote B and the Structures Monitoring Program with footnote E. The footnote E indicates that this line is consistent with the GALL Report for material, environment, and aging effect, but a different AMP is credited.

Since the GALL Report line items VII.G-1 and VII.G-2 only recommend the Fire Protection Program, it was not clear to the staff how these two programs will be used to manage the aging effects, as there are different frequencies and acceptance criteria recommended in these two programs. By letter dated November 13, 2009, the staff issued RAI 3.3.2.1-A requesting that the applicant clarify how these two programs will be used to manage the aging effects of elastomer fire barrier penetration seals, and clearly indicate what will be the frequency of inspection, and what acceptance criteria will be used.

In its response dated December 14, 2009, the applicant stated that the Fire Protection Program ensures that approximately 10 percent of each type of penetration seal is included in the 35 percent of fire penetration seals that are visually inspected at each 18-month interval. The applicant also stated that the Structures Monitoring Program inspects elastomer seals without regard to fire function of the seal (fire protection or other functions). The applicant further stated that Structures Monitoring Program inspections are performed in addition to, and not instead of, inspections under the Fire Protection Program. The specific aging effects for elastomers that are managed by this program include the following:

- deterioration of seals – loss of sealing and leakage through containment
- ionizing radiation – change in material properties and cracking
- weathering – increased hardness and shrinkage

The applicant further stated that the frequency of inspection will be based on the environment (harsh or non-harsh), but shall not exceed one inspection every 10 years. The visual inspections conducted under the Structures Monitoring Program are performed by qualified personnel possessing appropriate expertise with structural elastomers. The applicant also stated that elastomers which show signs of degradation (e.g., loss of seal, leakage, hardening, and cracking) that could impair the components' function would be repaired or dispositioned within the Corrective Action Program.

The staff reviewed the applicant's response and noted that the applicant is consistent with the GALL Report recommendation of crediting the Fire Protection Program to manage the aging effects of increased hardness and shrinkage and loss of strength of elastomer fire barrier penetration seals exposed to indoor and outdoor air. The staff reviewed the applicant's Fire Protection Program and its evaluation is documented in SER Section 3.0.3.2.4. The staff also noted that the applicant visually inspects all penetration seals as part of the structures walkdown performed for the Structures Monitoring Program.

Based on its review, the staff finds the applicant's response acceptable because: (1) the Structures Monitoring Program is used in addition to the GALL Report recommended Fire Protection Program, (2) qualified personnel are performing the inspections for aging effects recommended by the GALL Report, and (3) acceptance criteria and corrective actions are as recommended by the GALL Report for the Fire Protection Program. The staff concludes that the use of the Structures Monitoring Program in addition to the Fire Protection Program is acceptable. The staff's concern described in RAI 3.3.2.1-A is resolved.

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).

3.3.2.1.12 Loss of Material Due to Wear

LRA Table 3.3-1, item 3.3.1-63 addresses loss of material due to wear in steel fire-rated doors exposed to indoor or outdoor uncontrolled air.

The two AMR results (unique items) summarized in GALL Report, Table 3, item 63 are:

(1) item VII.G-3, steel fire-rated doors in air-indoor uncontrolled environment, with an aging effect of loss of material due to wear

(2) item VII.G-4, steel fire-rated doors in air-outdoor environment, with an aging effect of loss of material due to wear

The staff noted that the applicant stated in the LRA Table 3.3.1, item 3.3.1-63 discussion column that this line is not applicable to the auxiliary systems and that wear of steel fire doors exposed to air is managed by the Fire Protection Program, and that this is addressed in Section 3.5. The staff noted that this line item is referenced in LRA Tables 3.5.2-2, 3.5.2-4, 3.5.2-8, 3.5.2-9, and 3.5.2-11.

The staff reviewed LRA Tables 3.5.2-2, 3.5.2-4, 3.5.2-8, 3.5.2-9, and 3.5.2-11 and noted that item 3.3.1-63 is referenced in one line item in Table 3.5.2-2, one line item in Table 3.5.2-4, two line items in Table 3.5.2-8, two line items in Table 3.5.2-9, and one line item in Table 3.5.2-11. However, in Table 3.5.2-8, for the two line items for carbon steel fire door in an air-indoor uncontrolled environment, the applicant has credited the Fire Protection Program in one line item, and the Structures Monitoring Program in the other line item and referenced footnote E that indicates that this line is consistent with the GALL Report item for material, environment, and aging effect, but a different AMP is credited.

Since Table 3.3.1, item 3.3.1-63 does not address the Structures Monitoring Program, the staff determined that additional information was needed to complete its review. By letter dated

November 13, 2009, the staff issued RAI 3.3.2.1-2 requesting that the applicant provide additional information to resolve the discrepancy between the discussion column of LRA Table 3.3.1, line 3.3.1-63 and LRA Table 3.5.2-8; and if the Structures Monitoring Program is also used, to clarify how these two programs will be used to manage the aging effect of loss of material of steel fire doors.

In its response dated December 14, 2009, the applicant stated that both the Fire Protection Program and the Structures Monitoring Program manage the fire doors for loss of material. The applicant further stated that the line item in LRA Table 3.5.2-8 which cites the Structures Monitoring Program for managing the fire doors for loss of material should have referenced a different 3.x.1 table item. Accordingly the applicant revised the LRA as follows:

> In LRA Table 3.5.2-8, Summary of Aging Management Review Results for Pump House, on page 3.5-94, in the line item for fire door with aging effect requiring management of loss of material, managed by the Structures Monitoring Program, the NUREG-1801 Volume 2 Line Item is changed from VII.G-3 (A-21) to III.A3-12 (T-11), and the Table 3.X-1 Item is changed from 3.3.1-63 to 3.5.1-25, and the Notes entry is changed from E to A.

The staff reviewed GALL Report item III.A3-12 and noted that it recommends the Structures Monitoring Program to manage loss of material of steel components in an air-indoor or air-outdoor environment. The staff also verified that LRA Tables 3.5.2-2, 3.5.2-4, 3.5.2-9, and 3.5.2-11 have two line items for fire doors, with one line item referencing item 3.3.1-63 with footnote B, and the other referencing 3.5.1-25 with footnote A.

Based on its review, the staff finds the applicant's response to the RAI acceptable because the revision to the LRA proposed by the applicant will make the Table 3.5.2.8 fire door lines consistent with the other LRA Tables and consistent with the GALL Report recommendations. The staff's concern described in RAI 3.3.2.1-2 is resolved.

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).

3.3.2.1.13 Loss of Material Due to General, Pitting, and Crevice Corrosion

LRA Table 3.3-1, item 3.3.1-64 addresses loss of material due to general, pitting, and crevice corrosion, in steel piping, piping components, and piping elements exposed to fuel oil.

The AMR result (unique item) summarized in the GALL Report, Table 3, item 64 is item VII.G-21, steel piping, piping components, and piping elements in the fire protection system in an environment of fuel oil with an aging effect of loss of material due to general, pitting, and crevice corrosion. For this line item, the GALL Report recommends managing the aging effects with the Fire Protection and Fuel Oil Chemistry programs.

The staff noted that the applicant has used item VII.G-21 for component type accumulator, pulsation damper, low pressure tank in LRA Table 3.3.2-11, fire protection system. The applicant credits its Fuel Oil Chemistry and One-Time Inspection programs to manage the aging effect, and referenced footnote E, indicating that this line is consistent with the GALL Report item for material, environment, and aging effect, but a different AMP is credited. The applicant has also referenced plant-specific footnote 202, which states that additional aging mechanisms such as galvanic corrosion, MIC, wear, and/or selective leaching are also included.

The GALL Report recommended Fire Protection Program is a periodic inspection program used to verify the effectiveness of the Fuel Oil Chemistry Program. It is not clear to the staff how the One-Time Inspection Program will perform the same level of verification. Furthermore, the applicant has not provided any justification for considering selective leaching for carbon steel material, which is not susceptible to this aging mechanism.

By letter dated November 13, 2009, the staff issued RAI 3.3.2.1-3 requesting that the applicant justify the use of the One-Time Inspection Program in lieu of the periodic inspections as recommended by the Fire Protection Program, and to provide the basis for considering selective leaching to be an aging mechanism for carbon steel material in a fuel oil environment.

In its response dated December 14, 2009, the applicant stated that the component that is represented by this line item in LRA Table 3.3.2-11 is the fire protection system diesel fire pump fuel oil day tank, which is a relatively small (300 gallon) indoor tank that is classified as an accumulator in the DAEC equipment database. The applicant further stated that in the GALL Report component listings, most accumulators are grouped as piping components, and in this case, the Fire Protection Program, as recommended by the GALL Report, was not appropriate for this component.

The applicant also stated that instead of GALL Report item VII.G-21, a more appropriate GALL Report item is VII.H1-10 for carbon steel components and tanks in a fuel oil environment and managed by the Fuel Oil Chemistry and One-Time Inspection programs. The applicant further stated that these programs adequately manage for loss of material by controlling the quality of fuel oil added and stored in the tank, and additionally the program requires the tank to be periodically drained and cleaned. The applicant stated that verification of the effectiveness of the chemistry program is verified by performing periodic wall thickness measurements of the tank bottom.

The applicant revised the LRA as follows:

- In LRA Table 3.3.2-11, on page 3.3-128, in the line item for Accumulator, pulsation damper, low pressure tank with an environment of fuel oil, the GALL Report Volume 2 line item reference is changed to VII.H1-10 and the corresponding 3.X-1 Table item is changed to 3.3.1-20.
- In LRA Table 3.3-1, line item 3.3.1-64 on page 3.3-57, the discussion entry is revised to read, “Not Applicable at DAEC. The auxiliary systems have no Fire Protection carbon steel piping components exposed to fuel oil.”

The applicant further stated that footnote 202 is a generic note to address additional aging effects in addition to the ones in the GALL Report. In this case, the applicant stated that the additional aging effect managed is loss of material due to galvanic corrosion due to the fact that there is a stainless steel valve attached to the tank wall; and that selective leaching is not managed for this carbon steel tank.

The staff reviewed GALL Report item VII.H1-10, in the diesel fuel oil system, for steel piping, piping components, piping elements, and tanks in a fuel oil environment and noted that the

GALL Report recommends the Fuel Oil Chemistry and One-Time Inspection programs and recommends further evaluation of the detection of aging effects. The staff noted that GALL Report item VII.H1-10 is invoked by SRP-LR, Table 3.3.-1, item 20 and is addressed in Section 3.3.2.2.9.1. The staff reviewed Table 3.3-1, item 20 and its evaluation is documented in SER Section 3.3.2.2.9.1. The staff finds the LRA change to GALL Report item VII.H1-10 to be acceptable because the change is consistent with the GALL Report. The staff finds the applicant's response regarding footnote 202 acceptable because the footnote provides generic information on additional aging mechanisms, and for the carbon steel tanks in a fuel oil environment, selective leaching is not an aging mechanism that needs to be managed. The staff also finds the applicant's response regarding the change to the discussion column of item 3.3.1-64 acceptable because the reference for the accumulator in LRA Table 3.3.2-11 is changed from item 3.3.1-64 to item 3.3.1-20 and, therefore, item 3.3.1-64 is no longer applicable. The staff finds the response to RAI 3.3.2.1-3 acceptable because the line item is consistent with the GALL Report item VII.H1-10. The staff's concern described in RAI 3.3.2.1-3 is resolved.

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).

3.3.2.1.14 Concrete Cracking and Spalling Due to Aggressive Chemical Attack, and Reaction with Aggregates

LRA Table 3.3-1, item 3.3.1-65 addresses concrete cracking and spalling due to aggressive chemical attack, and reaction with aggregates in reinforced concrete structural fire walls, ceilings, and floors exposed to indoor uncontrolled air.

The one AMR result (unique item) summarized in the GALL Report, Table 3, item 65 is item VII.G-28, reinforced concrete structural fire barriers walls, ceilings, and floors in an air-indoor uncontrolled environment with an aging effect of concrete cracking and spalling. For this line item, the GALL Report recommends managing the aging effects with the Fire Protection and Structures Monitoring programs.

The staff noted that the applicant stated in the LRA Table 3.3-1, item 3.3.1-65 discussion column that this line is not applicable to the auxiliary systems, however, cracking and spalling due to aggressive chemical attack of reinforced concrete structural fire barriers exposed to indoor air is managed by the Fire Protection and Structural Monitoring programs, and that this is addressed in LRA Section 3.5.

The staff reviewed LRA Section 3.5, Tables 3.5.2-1 to 3.5.2-11 and could not find any line item that referenced Table 3.3-1, item 3.3.1-65 where the Structures Monitoring Program was credited.

By letter dated November 13, 2009, the staff issued RAI 3.3.2.1-4 requesting that the applicant confirm if the Structures Monitoring Program is used in addition to the Fire Protection Program in Table 3.3-1, item 3.3.1-65, and if not used, to justify the inclusion of the Structures Monitoring Program in the discussion column.

In its response dated December 14, 2009, the applicant stated that in nearly all cases, when there is a line item in a 3.5.2-X table that lists a Table 3.X-1 item of 3.3.1-65, the next line item is identical in component, material, environment, and aging effect requiring management, but the second line cites the Structures Monitoring Program. The applicant further stated that the Structures Monitoring Program references the applicable structural 3.X-1 table line item rather than 3.3.1-65. The applicant also stated that the discussion entry for Table 3.3-1, item 3.3.1-65 does not need to cite the Structures Monitoring Program, and for clarity, the LRA discussion entry for item 3.3.1-65 is being changed to read as follows:

> Not applicable to the Auxiliary Systems at DAEC. However, cracking and spalling, aggressive chemical attack of reinforced concrete structural fire barriers exposed to indoor air is managed by the Fire Protection Program (In Section 3.5).

The staff confirmed that in LRA Tables 3.5.2-X, the applicant has referenced line item 3.3.1-65 for only those AMR line items where the Fire Protection Program is credited, and that an appropriate Table 3.5-1 line item is referenced where the Structures Monitoring Program is credited.

Based on its review, the staff finds the applicant's response acceptable because: (1) the LRA change clarifies the wording in the discussion column of LRA Table 3.3-1, item 3.3.1-65 to indicate that line 3.3.1-65 is applicable for the Fire Protection Program only, and (2) the LRA is consistent with the GALL Report recommendation of the Fire Protection Program and the Structures Monitoring Program to manage the aging effect of cracking and spalling of reinforced concrete structural fire barriers exposed to indoor air. The staff's concern described in RAI 3.3.2.1-4 is resolved.

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).

3.3.2.1.15 Concrete Cracking and Spalling Due to Freeze-Thaw, Aggressive Chemical Attack, and Reaction with Aggregates

LRA Table 3.3-1, item 3.3.1-66 addresses concrete cracking and spalling due to freeze-thaw, aggressive chemical attack, and reaction with aggregates in reinforced concrete structural fire walls, ceilings, and floors exposed to outdoor air.

The one AMR result (unique item) summarized in the GALL Report, Table 3, item 66 is item VII.G-30, reinforced concrete structural fire barrier walls, ceilings, and floors in an air-outdoor environment with an aging effect of concrete cracking and spalling. For this line item, the GALL Report recommends managing the aging effects with the Fire Protection and Structures Monitoring programs.

The staff noted that the applicant stated in the LRA Table 3.3-1, item 3.3.1-66 discussion column that cracking and spalling of reinforced concrete structural fire barriers exposed to outdoor air is managed by the Structures Monitoring Program and that this is addressed in Section 3.5. This line item is referenced in LRA Table 3.5.2-2 for one component type on page 3.5-47, and in LRA Table 3.5.2-5 for four component types on pages 3.5-61, 3.5-66, and 3.5-67.

The staff reviewed LRA Tables 3.5.2-2 and 3.5.2-5, and noted that all lines in LRA Tables 3.5.2-2 and 3.5.2-5 that reference Table 3.3.1, item 3.3.1-66 as identified above, credit the Fire

Protection Program to manage cracking and spalling, and not the Structures Monitoring Program, and reference footnote B.

By letter dated November 13, 2009, the staff issued RAI 3.3.2.1-5 requesting that the applicant resolve the discrepancy between the discussion column of LRA Table 3.3.1, line 3.3.1-66 and LRA Tables 3.5.2-2 and 3.5.2-5, and to confirm if only the Fire Protection Program is used, then justify why footnote E is not used, instead of footnote B.

In its response dated December 14, 2009, the applicant stated that the Structures Monitoring Program, which includes reinforced concrete structural fire barriers – walls, ceilings, and floors exposed to air-outdoor, will confirm the absence of AERMs. The applicant further stated that the Fire Protection Program will also perform its own fire barrier visual inspection by a qualified fire protection inspector to examine for any signs of degradation, such as cracking, and since the Fire Protection Program will perform its own inspection, the footnote B is still correct. For clarity, the applicant revised the discussion column of Table 3.3-1, line item 3.3.1-66 to read as follows:

> Cracking and spalling of reinforced concrete structural fire barriers exposed to outdoor air is managed by the Fire Protection and Structural Monitoring Programs at DAEC.

Furthermore, the applicant stated that during the review of Table 3.5.2-2 on page 3.5-47, it was determined that an incorrect GALL line item was cited. The applicant revised the LRA to correct the citation as follows:

> In LRA Table 3.5.2-2, Summary of Aging Management Review Results Control Building, in the line item for Concrete with an Aging Effect Requiring Management of expansion and cracking with an Aging Management Program of Fire Protection Program, the NUREG-1801 Volume 2 Line Item entry is changed to VII.G-29 (A-92) and the Table 3.X-1 Item entry is changed to 3.3.1-67.

The staff reviewed the change to the LRA Table 3.3.1, item 3.3.1-66 discussion column and finds it acceptable because it clarifies that both the Fire Protection and Structures Monitoring programs are credited for managing aging and it resolves the discrepancy between Table 3.3-1, item 3.3.1-66 and LRA Tables 3.5.2-2 and 3.5.2-5.

However, the staff reviewed the line entry change from GALL Report item VII.G-30 to VII.G-29, and finds the change not acceptable. The GALL Report item VII.G-29 addresses aging effect of loss of material due to corrosion of embedded steel, whereas the LRA Table 3.5.2-2 line item that is being revised, addresses an aging effect of expansion and cracking. In its letter dated January 14, 2010, the applicant revised its response to RAI 3.3.1.1-5 to state that the line item for concrete with an aging effect requiring management of expansion and cracking with an aging management program of Fire Protection Program, the aging effect is changed to loss of material, the GALL Report line item is changed to VII.G-29 (A-92) and the Table 3.3-1 item entry is changed to 3.3.1-67. On the basis that the applicant has changed the aging effect to loss of material, the staff finds the response acceptable because the GALL Report item VII.G-29 is for aging effect of loss of material and, therefore, the LRA is consistent with the GALL Report. The staff's concern described in RAI 3.3.2.1-5 is resolved.

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).

3.3.2.1.16 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion and Fouling

LRA Table 3.3-1, item 3.3.1-68 addresses loss of material due to general, pitting, and crevice corrosion, MIC, and fouling for steel piping, piping components, and piping elements exposed to raw water.

The LRA credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage this aging effect for steel valve dampers. The GALL report recommends the Fire Water System Program to manage this aging effect. The AMR line item in Table 3.2.2-6 that references GALL Report Table 3, item 68, cites generic note E, indicating that the AMR line item is consistent with the GALL Report material, environment, and aging effect, but a different AMP is credited.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.20. The staff reviewed the applicant's AMR line items associated with item 3.3.1-68 and noted that the applicant credited GALL Report AMR item VII.G-24 in LRA Table 3.2.2-6 for item 3.3.1-68. The GALL Report recommends using the Fire Water System Program to manage this aging effect.

The staff noted that in Table 3.2.2-6, the applicant credited the Fire Water System Program to manage loss of material for steel valve dampers. The staff determined that additional information was needed to complete its review. By letter dated November 13, 2009, the staff issued RAI 3.2.2.1-1 requesting that the applicant provide justification why two different programs are credited for the same material, environment, and aging effect combination.

In its letter dated December 14, 2009, the applicant stated that the components which credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program are two manual valves on the carbon bed filter drain lines, one per train, that return to each standby gas treatment room sump. The applicant further stated that the valves are normally open, are not liquid filled, and were conservatively assigned a raw water internal environment. The applicant also stated that since the valves rarely have raw water in them, the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program was determined to be the most appropriate program.

The applicant further stated that components credited under the Fire Water System Program were two control valves, the standby gas treatment carbon bed deluge isolation valves, one each per train, which are open to supply fire water (raw water) from the fire water system header to spray water on the carbon bed in either standby gas treatment train if carbon bed temperature exceeds a specific temperature. The applicant also stated that these control valves are normally closed with raw fire water in the pipe leading up to and including the control valves, and since the valves normally have an internal environment of raw water, the Fire Water System Program was determined to be most appropriate.

The staff finds the applicant's response to the RAI acceptable because the valves credited in the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program are not normally liquid filled and are not part of the fire water system and, therefore, would not be in the scope of the Fire Water System Program. The staff's concern described in RAI 3.2.2.1-1 is resolved.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, and its evaluation is documented in SER Section 3.0.3.1.20. The staff noted that GALL AMP XI.M38 recommends periodic visual inspection of steel piping, piping elements, and piping components during system and component surveillances or during the performance of maintenance activities. The staff determined that visual inspection of internal surfaces during the performance of periodic surveillance and maintenance activities will detect loss of material before loss of intended function. On this basis, the staff finds the applicant's Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable to manage the aging effect of loss of material in steel piping, piping elements, and piping components in a raw water internal environment.

The LRA credits the Bolting Integrity Program to manage this aging effect for carbon steel fasteners, bolting washers, and nuts. The GALL Report recommends the Fire Water System Program to manage this aging effect. The AMR line item in Table 3.3.2-11 that references GALL Report Table 3, item 68, cites generic note E indicating that the AMR line item is consistent with the GALL Report material, environment, and aging effect, but a different AMP is credited. The staff noted that this component is in an external environment of raw water, implying that it is underwater.

In LRA Section B.3.28, the applicant stated that its External Surfaces Monitoring Program provides the requirements for the inspection of bolting for steel components such as piping, piping components, ducting, and other components within the scope of license renewal. The staff noted that the applicant's External Surfaces Monitoring Program is described in LRA Section B.3.21 and was reviewed and found to be consistent with GALL AMP XI.M36, "External Surfaces Monitoring," with enhancements that do not affect bolting components. The staff also noted that the GALL Report AMP uses visual inspections at periodic intervals to detect age-related degradation. The staff reviewed the applicant's AMR line items associated with item 3.3.1-68 and noted that the applicant credited GALL Report AMR item VII.G-24 in LRA Table 3.3.2-11 for item 3.3.1-68.

Since the bolted connections appear to be underwater, the staff determined the need for additional information to complete its review. By letter dated November 13, 2009, the staff issued RAI 3.3.2.1-6 requesting that the applicant confirm how and at what frequency the visual inspection will be performed to detect age-related degradation.

In its response dated December 14, 2009, the applicant stated that in LRA Table 3.3.2-11 the fasteners referred to are the bolting, nuts, and washers which secure the pump and column sections of the electric fire pump, 1P048, and the diesel fire pump, 1P049. The applicant further stated that an RFO preplanned task is scheduled every RFO, when the circulating water pit, where the fire pumps are located, is drained and accessible; and a step is included in the preplanned task to inspect the condition of the pump, pump casing, and bolting of both fire pumps.

The staff reviewed the applicant's response to the RAI and finds it acceptable because the circulating water pit is drained and accessible during RFOs and the bolting can be visually inspected for loss of material through the External Surfaces Monitoring Program. The staff finds the Bolting Integrity Program that uses the External Surfaces Monitoring Program for visual inspections to be acceptable. The staff's concern described in RAI 3.3.2.1-6 is resolved.

The LRA credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage this aging effect for carbon steel filters, screens, and strainers. The GALL Report recommends the Fire Water System Program to manage this aging effect. The AMR line item in Table 3.3.2-18 that references GALL Report Table 3, item 68, cites generic note E indicating that the AMR line item is consistent with the GALL Report material, environment, and aging effect, but a different AMP is credited. The staff noted that the LRA also references plant-specific footnote 220, indicating that raw water is well water that comes from wells.

The staff noted that these components are in the plant ventilation system and not in the fire protection system and, therefore, would not be in the scope of the Fire Water System Program. The staff reviewed the applicant’s Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, and its evaluation is documented in SER Section 3.0.3.1.20. The staff reviewed the applicant’s AMR line items associated with item 3.3.1-68 and noted that the applicant credited GALL Report AMR item VII.G-24 in LRA Table 3.3.2-18 for item 3.3.1-68. The staff noted that the GALL Report AMP recommends periodic visual inspections of steel piping, piping elements, and piping components during system and component surveillances or during the performance of maintenance activities. The staff determined that visual inspection of internal surfaces during the performance of periodic surveillance and maintenance activities will detect loss of material before loss of intended function. On this basis, the staff finds the applicant’s Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable to manage the aging effect of loss of material in steel piping, piping elements, and piping components in a raw water internal environment.

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).

3.3.2.1.17 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion, Fouling, and Lining/Coating Degradation

LRA Table 3.3-1, item 3.3.1-76 addresses the loss of material due to general, pitting, and crevice corrosion, MIC, fouling, and lining/coating degradation of steel piping, piping components, and piping elements (without lining/coating or with degraded lining/coating) exposed to raw water. The applicant proposes to manage this aging effect through its Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, External Surfaces Monitoring Program, Bolting Integrity Program, Open-Cycle Cooling Water System Program, and the Flow-Accelerated Corrosion Program. The GALL Report recommends that this aging effect be managed through the use of GALL AMP XI.M20, “Open-Cycle Cooling Water System.” The applicant proposes that the AMR items are either consistent with the GALL Report in all respects (generic note A) or are consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited (generic note E).

The staff reviewed the applicant’s Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, External Surfaces Monitoring Program, Bolting Integrity Program, Open-Cycle Cooling Water System Program, and Flow-Accelerated Corrosion Program and its evaluations are documented in SER Sections, 3.0.3.1.20, 3.0.3.2.3, 3.0.3.1.6, 3.0.3.1.22, and 3.0.3.1.17, respectively.

The staff reviewed components subordinate to LRA item 3.3.1-76 for which the applicant assigned generic note E and for which the applicant proposes to use the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff noted that the applicant selected a GALL Report item for which the Open-Cycle Cooling Water System Program was the recommended program. The staff also noted that for these subordinate items, the applicant identified the intended function of the component as leakage boundary (spatial). LRA Table 2.1-1 defines leakage boundary (spatial) as applying only to nonsafety-related systems. However, the scope of GALL AMP XI.M20 is limited to components which transfer heat from safety-related systems to the ultimate heat sink. The staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program an appropriate means of managing aging for the components under consideration because the aging effect under consideration, loss of material, is adequately detected by visual inspection and the applicant's proposed program contains appropriate visual inspection methods.

The staff reviewed components subordinate to LRA item 3.3.1-76 for which the applicant assigned generic note E and for which the applicant proposes to use the External Surfaces Monitoring Program. The staff noted that the applicant selected a GALL Report item for which the Open-Cycle Cooling Water System Program was the recommended program. The staff also noted that for the subordinate item, the applicant identified the component as traveling screens. The staff further noted that at least some portions of the intakes and traveling screens are scoped into license renewal as safety-related components. In the absence of evidence to the contrary, the staff finds that the applicant appropriately selected an AMR item for which the recommended AMP is the Open-Cycle Cooling Water System Program. The Open-Cycle Cooling Water System Program implements GL 89-13 for license renewal. GL 89-13 contains five actions to be undertaken by license holders. Two of these actions, monitoring for corrosion and monitoring for the presence of biofouling, appear to be specifically applicable to traveling screens. Enclosure 1 to GL 89-13 specifically cites inspection of the intake structure, of which the traveling screens appear to be a part, to detect biofouling. While it is clear to the staff that the applicant's external surfaces monitoring program is designed to detect loss of material from external surfaces such as the traveling screen, and it is also clear that in the process of inspecting the screens for loss of material, the presence of biofouling would be detected, it is not clear to the staff that the External Surfaces Monitoring Program will be fully effective in managing the aging of these components.

By letter dated November 13, 2009, the staff issued RAI 3.3.2.1-a requesting that the applicant manage the aging of these components using the Open-Cycle Cooling Water System Program, or justify why the Open-Cycle Cooling Water System Program is not applicable to these components or why the applicant's External Surfaces Monitoring program will be fully effective in managing the aging of these components.

In its response dated December 14, 2009, the applicant agreed with the staff that the Open-Cycle Cooling Water System Program was the appropriate AMP to manage the aging of the traveling screens. The applicant modified LRA Table 3.3.2-16 to reflect the new AMP and to change the generic note to A.

Based on its review, the staff finds the applicant's response to the RAI acceptable because its currently proposed AMP is consistent with the GALL Report. The staff's concern described in RAI 3.3.2.1-a is resolved.

The staff reviewed components subordinate to LRA item 3.3.1-76 for which the applicant assigned generic note E and for which the applicant proposes to use the Bolting Integrity

Program. The staff noted that the applicant selected a GALL Report item for which the Open-Cycle Cooling Water System Program was the recommended program. The staff also noted that for these subordinate items, the applicant identified the component/material/environment combination as carbon steel fasteners, bolting, washers, and nuts exposed to raw water on external surfaces. The intent of the Open-Cycle Cooling Water System Program is to address corrosion and other issues predominantly on the inside of service water piping. The staff finds that the applicant's Bolting Integrity Program is an appropriate means of managing aging for the components under consideration because this AMP is specifically designed to address aging associated with bolting including loss of material due to corrosion and loss of preload.

The staff reviewed components subordinate to LRA item 3.3.1-76 for which the applicant assigned generic note E and for which the applicant proposes to use the Flow-Accelerated Corrosion Program. The staff noted that the applicant selected a GALL Report item for which the Open-Cycle Cooling Water System Program was the recommended program. The staff also noted that the applicant identified the subordinate items as carbon steel pipe, pipe fittings, hoses, tubes and rupture disks exposed to raw water on internal surfaces. The staff noted that the open-cycle cooling water system program described in the GALL Report includes routine inspections to ensure that corrosion, erosion, and other degradation mechanisms cannot degrade the performance of safety-related systems serviced by open-cycle cooling water system. The staff finds that the applicant's Flow-Accelerated Corrosion Program is an appropriate means of managing aging for the components under consideration because this AMP, as clarified in its follow-up response to RAI B3.24-1 dated February 2, 2010, the applicant provided details on their Flow-Accelerated Corrosion Program indicating that it will detect and initiate corrective actions for loss of material due to corrosion and erosion in carbon steel pipe and components exposed to raw 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).

3.3.2.1.18 Loss of Material Due to General, Pitting, Crevice, Galvanic, and Microbiologically-Influenced Corrosion and Fouling

LRA Table 3.3-1, item 3.3.1-77 addresses the loss of material due to general, pitting, and crevice corrosion and MIC, as well as fouling of steel heat exchanger components, exposed to raw water. The applicant proposes to manage this aging effect through its Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components, External Surfaces Monitoring, and Open-Cycle Cooling Water System programs. The GALL Report recommends that this aging effect be managed through the use of GALL AMP XI.M20, "Open-Cycle Cooling Water System." The applicant proposes that the AMR items are either consistent with the GALL Report in all respects (generic note A) or are consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited (generic note E).

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, External Surfaces Monitoring Program, and Open-Cycle Cooling Water System Program and its evaluations are documented in SER Sections 3.0.3.1.20, 3.0.3.2.3, and 3.0.3.1.22, respectively.

The staff reviewed components subordinate to LRA item 3.3.1-77 for which the applicant assigned generic note E and for which the applicant proposes to use the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff noted that the applicant selected a GALL Report item for which the Open-Cycle Cooling Water System Program was the recommended program. The staff also noted that for these subordinate items, the applicant identified the intended function of the component as leakage boundary (spatial). LRA Table 2.1-1 defines leakage boundary (spatial) as applying only to nonsafety-related systems. However, the scope of GALL AMP XI.M20 is limited to components which transfer heat from safety-related systems to the ultimate heat sink. The staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program an appropriate means of managing aging for the components under consideration because the aging effect under consideration, loss of material, is adequately detected by visual inspection and the applicant's proposed program contains appropriate visual inspection methods.

The staff reviewed components subordinate to LRA item 3.3.1-77 for which the applicant assigned generic note E and for which the applicant proposes to use the External Surfaces Monitoring Program. The staff noted that the applicant selected a GALL Report item for which the Open-Cycle Cooling Water System Program was the recommended program. The staff also noted that for these subordinate items, the applicant identified the intended function of the component as leakage boundary (spatial). LRA Table 2.1-1 defines leakage boundary (spatial) as applying only to nonsafety-related systems. However, the scope of GALL AMP XI.M20 is limited to components which transfer heat from safety-related systems to the ultimate heat sink. The staff finds the applicant's External Surfaces Monitoring Program an appropriate means of managing aging for the components under consideration because the aging effect under consideration, loss of material, is adequately detected by visual inspection and the applicant will be enhancing its program to address the types of components to be inspected, the relevant degradation mechanisms and effects of interest, the qualifications required for inspection personnel, and the acceptance criteria for the component/aging effect combination to be sure that corrective actions will be identified before loss of 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, as required by 10 CFR 54.21(a)(3).

3.3.2.1.19 Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.3-1, item 3.3.1-78 addresses loss of material due to pitting and crevice corrosion in stainless steel, nickel alloy, and copper alloy piping, piping components, and piping elements exposed to raw water.

The LRA credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage this aging effect for nickel valve dampers. The GALL Report recommends the Open-Cycle Cooling Water System Program to manage this aging effect. The AMR line item in Table 3.3.2-13 that references GALL Report Table 3, item 78, cites generic note E, indicating that the AMR line item is consistent with the GALL Report material, environment, and aging effect, but a different AMP is credited.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.20. The staff reviewed the applicant's AMR line items associated with item 3.3.1-78 and noted that the applicant credited GALL Report AMR item VII.C1-13 in LRA Table 3.3.2-13 for item 3.3.1-78. The GALL Report recommends using the Open-Cycle Cooling Water System Program to manage this aging effect. The staff noted that GALL AMP XI.M20, “Open-Cycle Cooling Water System,” recommends the provisions of NRC GL 89-13 which includes visual and nondestructive inspections, as well as preventive measures such as introduction of biocides, chemical treatments, and periodic flushing, to manage loss of material in accordance with the applicant’s commitments under GL 89-13. The staff noted that GALL AMP XI.M38, “Internal Surfaces in Miscellaneous Piping and Ducting Components Program,” provides for only visual examinations of components during maintenance procedures for components that are not covered by other AMPs. Additionally, the staff noted that GALL AMP XI.M38 does not provide for preventive actions because it is an inspection program. The staff determined that additional information was required to complete its review. By letter dated November 13, 2009, the staff issued RAI 3.3.2.13-1 requesting that the applicant provide justification for not using GALL AMP XI.M20 to manage loss of material of nickel components exposed to raw water.

In its response dated December 14, 2009, the applicant stated that GALL AMP XI.M20 relies on implementation of the recommendations of NRC GL 89-13, “Service Water System Problems Affecting Safety-Related Equipment,” to ensure that the effects of aging on the open-cycle cooling water or service water system will be managed for the period of extended operation. The applicant further stated that GL 89-13 applies to safety-related raw water systems, including its river water supply system, RHR service water system, and emergency service water system. The applicant also stated that its GSW system does not provide raw water to safety-related components and is not in the scope of either GL89-13 or the Open-Cycle Cooling Water System Program and that the GSW system is within the scope of license renewal for 10 CFR 54.4(a)(2) with the intended function of leakage boundary (spatial).

The applicant stated that the nickel alloy components in the GSW system that are within the scope of license renewal, are ¾-inch supply and drain valves (V46-0258 and V46-0259) to corrosion monitor 1C713 and that these components are not within the scope of the Open-Cycle Cooling Water System Program, and do not reasonably fit within other AMPs. The applicant stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is an appropriate program for managing components such as these for loss of material.

The staff reviewed the applicant’s response to the RAI and finds it acceptable because the components addressed in this AMR line item are not in the scope of GL 89-13 because they are not in a safety-related raw water system and the visual examination of these components under the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will detect loss of material of nickel piping, piping components, and piping elements exposed to raw water. The staffs concern described in RAI 3.3.2.2.7-1 is resolved.

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).

3.3.2.1.20 Loss of Material Due to Pitting and Crevice Corrosion

LRA Table 3.3-1, item 3.3.1-78 addresses the loss of material due to pitting and crevice corrosion of stainless steel, nickel alloy, and copper alloy piping, piping components, and piping elements exposed to raw water. The applicant proposes to manage this aging effect through its

Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The GALL Report recommends that this aging effect be managed through the use of GALL AMP XI.M20, “Open-Cycle Cooling Water System.” The applicant proposes that the AMR items are consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited (generic note E).

The staff reviewed the applicant’s Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.20.

The staff reviewed components subordinate to LRA item 3.3.1-78 for which the applicant assigned generic note E and for which the applicant proposes to use its Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff noted that the applicant selected a GALL Report item for which the Open-Cycle Cooling Water System Program was the recommended program. The staff also noted that for these subordinate items, the applicant identified the intended function of the component as leakage boundary (spatial). LRA Table 2.1-1 defines leakage boundary (spatial) as applying only to nonsafety-related systems. However, the scope of GALL AMP XI.M20 is limited to components which transfer heat from safety-related systems to the ultimate heat sink. The staff finds the applicant’s Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program an appropriate means of managing aging for the components under consideration because the aging effect under consideration, loss of material, is adequately detected by visual inspection and the applicant’s proposed program contains appropriate visual inspection methods.

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).

3.3.2.1.21 Loss of Material Due to Pitting and Crevice Corrosion, and Fouling

LRA Table 3.3-1, item 3.3.1-79 addresses 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 effect through its Open-Cycle Cooling Water System Program. In items subordinate to item 3.3.1-79, the applicant proposes to manage this aging effect through the use of its Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, External Surfaces Monitoring Program, Bolting Integrity Program, and Open-Cycle Cooling Water System Program. The GALL Report recommends that this aging effect be managed through the use of GALL AMP XI.M20, “Open-Cycle Cooling Water System.” The applicant proposes that the AMR items are either consistent with the GALL Report in all respects (generic note A) or are consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited (generic note E).

The staff reviewed the applicant’s Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, External Surfaces Monitoring Program, Bolting Integrity Program, and Open-Cycle Cooling Water System Program and its evaluations are documented in SER Sections 3.0.3.1.20, 3.0.3.2.3, 3.0.3.1.6, and 3.0.3.1.22, respectively.

The staff noted in its comparison of LRA item 3.3.1-79 with its subordinate items that LRA item 3.3.1-79 lists “Open-Cycle Cooling Water System” as the only AMP used for this LRA item. The staff also noted that subordinate items list other programs. It is not clear to the staff whether

LRA item 3.3.1-79 is missing programs or whether the subordinate items contain AMPs which are not being used. By letter dated November 13, 2009, the staff issued RAI 3.3.2.1-d1 requesting that the applicant modify LRA item 3.3.1-79 to include all AMPs being used or modify the subordinate items to indicate that only the Open-Cycle Cooling Water System Program is being used.

In its response dated December 14, 2009, the applicant stated that the discussion column for LRA Table 3.3.1, item 3.3.1-79 had been revised so as to include the AMPs "Open-Cycle Cooling Water System," "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," "Bolting Integrity," and "External Surfaces Monitoring."

Based on its review, the staff finds the applicant's response to the RAI acceptable because item 3.3.1-79 is now consistent with items subordinate to it. The staff's concern described in RAI 3.3.2.1-d1 is resolved.

The staff reviewed components subordinate to LRA item 3.3.1-79 for which the applicant assigned generic note E and for which the applicant proposes to use the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff noted that the applicant selected a GALL Report item for which the Open-Cycle Cooling Water System Program was the recommended program. The staff also noted that for these subordinate items, the applicant identified the intended function of the component as leakage boundary (spatial). LRA Table 2.1-1 defines leakage boundary (spatial) as applying only to nonsafety-related systems. However, the scope of the GALL AMP XI.M20 is limited to components which transfer heat from safety-related systems to the ultimate heat sink. The staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program an appropriate means of managing aging for the components under consideration because the aging effect under consideration, loss of material, is adequately detected by visual inspection and the applicant's proposed program contains appropriate visual inspection methods.

The staff reviewed components subordinate to LRA item 3.3.1-79 for which the applicant assigned generic note E and for which the applicant proposes to use the Bolting Integrity Program. The staff noted that the applicant selected a GALL Report item for which the Open-Cycle Cooling Water System Program was the recommended program. The staff also noted that for these subordinate items, the applicant identified the component/material/environment combination as stainless steel fasteners, bolting, washers, and nuts exposed to raw water on external surfaces. The staff further noted that the intent of the Open-Cycle Cooling Water System Program is to address corrosion and other issues predominantly on the inside surfaces of service water piping. The staff finds the applicant's Bolting Integrity Program an appropriate means of managing aging for the components under consideration, because the aging effects under consideration, corrosion and loss of preload, are adequately detected by this program.

The staff reviewed components subordinate to LRA item 3.3.1-79 for which the applicant assigned generic note E and for which the applicant proposes to use the External Surfaces Monitoring Program. The staff noted that the applicant selected a GALL Report item for which the Open-Cycle Cooling Water System Program was the recommended program. The staff also noted that for the subordinate item, the applicant identified the component as filter, screens, and strainer. These components are included in LRA Table 3.3.2-16 which includes the intake and traveling screens. The staff further noted that at least some portions of the intakes and traveling screens are scoped into license renewal as safety-related components. In the absence of evidence to the contrary, the staff must find that the applicant appropriately selected an AMR item for which the recommended AMP is “Open-Cycle Cooling Water System.” The Open-Cycle Cooling Water System Program implements GL 89-13 for license renewal. GL 89-13 contains five actions to be undertaken by license holders. Two of these actions, monitoring for corrosion and monitoring for the presence of biofouling appear to be specifically applicable to traveling screens. Enclosure 1 to GL 89-13 specifically cites inspection of the intake structure, of which the traveling screens appear to be a part, to detect biofouling. While it is clear to the staff that the applicant’s External Surfaces Monitoring Program is designed to detect loss of material from external surfaces such as the traveling screen, and it is also clear that in the process of inspecting the screens for loss of material, the presence of biofouling would be detected, it is not clear to the staff that the External Surfaces Monitoring Program will be fully effective in managing the aging of these components. By letter dated November 13, 2009, the staff issued RAI 3.3.2.1-d2 requesting that the applicant manage the aging of these components using the Open-Cycle Cooling Water System Program or that the applicant justify why the Open-Cycle Cooling Water System Program is not applicable to these components or why the applicant’s External Surfaces Monitoring Program will be fully effective in managing the aging of these components.

In its response dated December 14, 2009, the applicant stated that the use of the External Surfaces Monitoring Program for the component under consideration was incorrect. The applicant modified LRA Table 3.3.2-16 to show the inclusion of the new AMP and to revise the generic note to A.

Based on its review, the staff finds the applicant’s response to the RAI acceptable because the applicant’s currently proposed AMP is consistent with the GALL Report. The staff’s concern described in RAI 3.3.2.1-d2 is resolved.

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).

3.3.2.1.22 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion and Fouling

LRA Table 3.3-1, item 3.3.1-81 addresses the loss of material due to pitting and crevice corrosion, and MIC, as well as fouling of copper alloy piping, piping components, and piping elements exposed to raw water. The applicant proposes to manage this aging effect through its Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and Open-Cycle Cooling Water System Program. The GALL Report recommends that this aging effect be managed through the use of GALL AMP XI.M20, “Open-Cycle Cooling Water System.” The applicant proposes that the AMR items are either consistent with the GALL Report in all respects (generic note A) or are consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited (generic note E).

The staff reviewed the applicant’s Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and Open-Cycle Cooling Water System Program and its evaluations are documented in SER Sections 3.0.3.1.20 and 3.0.3.1.22, respectively.

The staff reviewed components subordinate to LRA item 3.3.1-81 for which the applicant assigned generic note E and for which the applicant proposes to use the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff noted that the applicant selected a GALL Report item for which the Open-Cycle Cooling Water System Program was the recommended program. The staff also noted that for these subordinate items the applicant identified the intended function of the component as leakage boundary (spatial). LRA Table 2.1-1 defines leakage boundary (spatial) as applying only to nonsafety-related systems. However, the scope of GALL AMP XI.M20, “Open-Cycle Cooling Water System” is limited to components which transfer heat from safety-related systems to the ultimate heat sink. The staff finds the applicant’s Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program an appropriate means of managing aging for the components under consideration because the aging effect under consideration, loss of material, is adequately detected by visual inspection and the applicant’s proposed program contains appropriate visual inspection methods.

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).

3.3.2.1.23 Loss of Material Due to Pitting, Crevice, Galvanic, and Microbiologically-Influenced Corrosion and Fouling

LRA Table 3.3-1, item 3.3.1-82 addresses the loss of material due to pitting, crevice, and galvanic corrosion and MIC, as well as fouling of copper alloy heat exchanger components exposed to raw water. The applicant proposes to manage this aging effect through its Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and Open-Cycle Cooling Water System Program. The GALL Report recommends that this aging effect be managed through the use of GALL AMP XI.M20, “Open-Cycle Cooling Water System.” The applicant proposes that the AMR items are either consistent with the GALL Report in all respects (generic note A) or are consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited (generic note E).

The staff reviewed the applicant’s Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and Open-Cycle Cooling Water System Program and its evaluations are documented in SER Sections 3.0.3.1.20 and 3.0.3.1.22, respectively.

The staff reviewed components subordinate to LRA item 3.3.1-82 for which the applicant assigned generic note E and for which the applicant proposes to use the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff noted that the applicant selected a GALL Report item for which the Open-Cycle Cooling Water System Program was the recommended program. The staff also noted that for these subordinate items, the applicant identified the intended function of the component as leakage boundary (spatial). LRA Table 2.1-1 defines leakage boundary (spatial) as applying only to nonsafety-related systems. However, the scope of GALL AMP XI.M20, “Open-Cycle Cooling Water System” is limited to components which transfer heat from safety-related systems to the ultimate heat sink. The staff finds the applicant’s Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program an appropriate means of managing aging for the components under consideration because the aging effect under consideration, loss of material, is adequately detected by visual inspection and the applicant’s proposed program contains appropriate visual inspection methods.

The staff reviewed components subordinate to LRA item 3.3.1-82 for which the applicant assigned generic note E and for which the applicant proposes to use the Inspection of Internal

Surfaces in Miscellaneous Piping and Ducting Components Program. The staff noted that the applicant selected a GALL Report item for which the Open-Cycle Cooling Water System Program was the recommended program. The staff also noted that some of these items are listed in LRA Table 3.3.2-11, “Fire Protection System.” LRA Section 2.3.3.11 states that components in the fire protection system are scoped into license renewal in accordance with 10 CFR 54.4(a)(2) (nonsafety-related but their failure could prevent satisfactory accomplishment of the safety-related functions) and 10 CFR 54.4(a)(3) (demonstration of compliance with commission’s regulations). No portion of the fire protection system is scoped into license renewal in accordance with 10 CFR 54.4(a)(1) (safety-related). The staff further noted that the scope of GALL AMP XI.M20 is limited to components which transfer heat from safety-related systems to the ultimate heat sink. The staff finds the applicant’s Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program an appropriate means of managing aging for the components under consideration because the aging effect under consideration, loss of material, is adequately detected by visual inspection and the applicant’s proposed program contains appropriate visual inspection methods.

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).

3.3.2.1.24 Reduction of Heat Transfer Due to Fouling

LRA Table 3.3-1, item 3.3.1-83 addresses 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 effect through its Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and Open-Cycle Cooling Water System Program. The GALL Report recommends that this aging effect be managed through the use of GALL AMP XI.M20, “Open-Cycle Cooling Water System.” The applicant proposes that the AMR items are either consistent with the GALL Report in all respects (generic note A) or are consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited (generic note E).

The staff reviewed the applicant’s Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and Open-Cycle Cooling Water System Program and its evaluations are documented in SER Sections 3.0.3.1.20 and 3.0.3.1.22, respectively.

The staff reviewed LRA components subordinate to LRA item 3.3.1-83 for which the applicant assigned generic note E and for which the applicant proposes to use the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The staff noted that the applicant selected a GALL Report item for which the Open-Cycle Cooling Water System Program was the recommended program. The staff also noted that these items are listed in LRA Table 3.3.2-11, “Fire Protection System.” LRA Section 2.3.3.11 states that components in the fire protection system are scoped into license renewal in accordance with 10 CFR 54.4(a)(2) (nonsafety-related but their failure could prevent satisfactory accomplishment of the safety-related functions) and 10 CFR 54.4(a)(3) (demonstration of compliance with NRC regulations). No portion of the fire protection system is scoped into license renewal in accordance with 10 CFR 54.4(a)(1) (safety-related). The staff further noted that the scope of GALL AMP XI.M20 is limited to components which transfer heat from safety-related systems to the ultimate heat sink. The staff finds the applicant’s Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program an appropriate means of managing

aging for the components under consideration because the aging effect under consideration, heat transfer degradation, is normally the result of the accumulation of fouling on the heat exchanger tubes; fouling is adequately detected by visual inspection and the applicant's proposed program contains appropriate visual inspection methods.

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).

3.3.2.1.25 Loss of Material Due to Pitting and Crevice Corrosion

In LRA Table 3.3.2-.3, the applicant stated that for stainless steel pipe, pipe fittings, hoses, tubes, rupture disk, valve and damper exposed to treated water there is no aging effect and no AMP is proposed. The AMR line items cite generic note I, indicating that the aging effect in the GALL Report for this line item's component, material and environment combination is not applicable. These line items cite plant specific note 218, which states, "Material science evaluation for this material in this environment results in no aging effects requiring management."

In its review of LRA section 3.4.2, the staff noted that LRA Section 3.4.2.2.7 Item 1 referred to stainless steel piping components exposed to treated water. The staff further noted that the LRA states that stainless steel components exposed to treated water were managed for loss of material due to pitting and crevice corrosion by the Water Chemistry Program (B.3.39). The LRA further states that the effectiveness of the Water Chemistry Program would be confirmed by the One-Time Inspection Program (B.3.32) through an inspection of a representative sample of components crediting this program, including susceptible locations, such as areas of low or stagnant flow and areas of high concentrations of impurities. By email dated April 21, 2010, the staff requested that the applicant provide justification for why stainless steel piping components exposed to treated water in the chlorination and acid feed system is listed as having no aging effect or proposed aging management program, when the same material, component and environment combination is listed in the LRA Section 3.4.2.2.7 Item 1 as being managed for the loss of material by the Water Chemistry Program. Additionally, the staff requested that the applicant provide sufficient detail from the material science evaluation discussed in LRA footnote 218 to allow the staff to independently review the evaluation.

In its response dated April 28, 2010, the applicant stated that the components in the chlorination and acid feed system do not contain reactor coolant and do not communicate with the reactor. They also stated that GALL AMP XI.M2 and the LRA Water Chemistry AMP apply only to systems that contain reactor coolant and communicate with the reactor. The applicant further stated that upon consideration, they have revised the LRA to use the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material for these items. Additionally they referenced line item 3.3.1.-24 and cited generic note E.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.20. In its review of components associated with item number 3.3.1-24 for which the applicant assigned generic note E, the staff noted that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program proposes to manage the aging of stainless steel pipe, pipe fittings, hoses, tubes, rupture disk, valve and damper through the use of visual inspections of internal surfaces. The staff finds the applicant's use of Internal Surfaces in Miscellaneous

Piping and Ducting Components Program acceptable because it encompasses periodic visual inspections of piping, piping elements, ducting and components for detection of aging effects prior to the loss of component function. As such, the applicant's proposal to address loss of material due to pitting and crevice corrosion in stainless steel pipe, pipe fittings, hoses, tubes, rupture disk, valve and damper is therefore consistent with GALL Report item VII.E3-15. The staff's concern described in RAI 3.3.2.3-X is resolved.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM and AMP combinations not addressed in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.3.2, the applicant further evaluates aging management, as recommended by the GALL Report, for the auxiliary systems components and provides information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- reduction of heat transfer due to fouling
- cracking due to SCC
- cracking due to SCC and cyclic loading
- hardening and loss of strength due to elastomer degradation
- reduction of neutron-absorbing capacity and loss of material due to general corrosion
- loss of material due to general, pitting, and crevice corrosion
- loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion
- loss of material due to general, pitting, crevice and microbiologically-influenced corrosion, and fouling
- loss of material due to pitting and crevice corrosion
- loss of material due to pitting, crevice, and galvanic corrosion
- loss of material due to pitting, crevice, and microbiologically-influenced corrosion
- loss of material due to wear

- loss of material due to cladding breach
- QA for aging management of nonsafety-related components

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which the report recommends further evaluation, the staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.3.2.2. The staff's review of the applicant's further evaluation follows.

3.3.2.2.1 Cumulative Fatigue Damage

LRA Section 3.3.2.2.1 states that fatigue is a TLAA, as defined in 10 CFR 54.3, which must be evaluated in accordance with 10 CFR 54.21(c)(1). SER Section 4.3.3 documents the staff's review of the applicant's evaluation of TLAA for fatigue of Class 1, 2, and 3 piping and components. SER Section 4.7.1 documents the staff's review of the applicant's evaluation of TLAA for the cranes designed for the reactor building and turbine building.

3.3.2.2.2 Reduction of Heat Transfer Due to Fouling

The staff reviewed LRA Section 3.3.2.2.2 against the criteria in SRP-LR Section 3.3.2.2.2.

LRA Table 3.3-1, item 3.3.1-3 addresses stainless steel heat exchanger tubes exposed to treated water. The applicant stated that this item is not applicable because the auxiliary systems have no stainless steel heat exchanger tubes exposed to treated water. The staff reviewed the UFSAR to verify the design of the auxiliary systems. Based on information in the UFSAR, the staff confirmed that the applicant's plant does not have stainless steel heat exchanger tubes exposed to treated water in the auxiliary systems.

Based on the above, the staff concludes SRP-LR Section 3.3.2.2.2 criteria is not applicable.

3.3.2.2.3 Cracking Due to Stress Corrosion Cracking

The staff reviewed LRA Section 3.3.2.2.3 against the following criteria in SRP-LR Section 3.3.2.2.3:

(1) LRA Section 3.3.2.2.3.1 addresses cracking due to SCC in stainless steel piping, piping components, and piping elements of the BWR standby liquid control system exposed to sodium pentaborate solution greater than 60 °C (greater than 140 °F). The applicant stated that the standby liquid control system piping containing sodium pentaborate solution is less than 60 °C (less than 140 °F) and thus not applicable. The applicant also stated that the piping upstream of the containment isolation valves is exposed to temperatures greater than 60 °C (greater than 140 °F) and will be managed by the Water Chemistry and ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD programs. The staff reviewed the applicant's Technical Specifications and noted that Figure 3.1.7-2 shows the acceptable temperature limit for the sodium pentaborate solution as 110 °F. In addition, the staff noted in a letter dated February 2, 2010, in response to RAI 3.3.2.2.3.1-1, the applicant stated that the portion of the standby liquid control system that contains sodium pentaborate includes the sodium pentaborate tank with associated pumps, valves, and injection piping out to two squib

valves that maintain positive isolation is at less than 140 °F. Based on this information, the staff agrees with the applicant that the standby liquid control system piping exposed to sodium pentaborate is less than 60 °C (less than 140 °F) and finds the applicant's determination of not applicable acceptable.

In the conduct of its review, the staff was not able to find any items subordinate to item 3.3.1-4. Additionally, the staff conducted a search of the LRA for "sodium pentaborate solution." This search identified several instances in the LRA where sodium pentaborate solution appeared but none were associated with cracking of stainless steel at temperatures above 60 ^{o}C. The lack of items subordinate to LRA item 3.3.1-4 could be interpreted to mean that this item is not applicable. Alternatively, it could indicate items missing from the LRA. By letter dated January 6, 2010, the staff issued RAI 3.3.2.2.3.1-1 requesting that the applicant explain the apparent lack of items subordinate to LRA item 3.3.1-4 and provide any missing information.

In its response dated February 2, 2010, the applicant stated that: (1) the portion of the standby liquid control system that contains sodium pentaborate includes the sodium pentaborate tank with associated pumps, valves, and injection piping out to two squib valves that maintain positive isolation. This part of the system is at less than140 °F and is represented by those line items in Table 3.3.2-30 that have the environment "Sodium pentaborate solution (internal)." (2) A pipe segment of the system downstream of the two squib valves, toward the reactor vessel up to the inboard containment isolation check valve, is Class 2, less than 140 °F, and is considered to have a sodium pentaborate environment. This stainless steel pipe is included in Table 3.3.2-30 with the environment "Sodium pentaborate solution (internal)." (3) Downstream of the inboard containment isolation check valve, toward the reactor vessel, there is a change of pipe class. This pipe segment includes the containment isolation check valve and the remaining injection piping that extends to vessel penetration. This segment is Class 1 and is at greater than 140 °F, but the environment is reactor coolant, not sodium pentaborate. This segment is addressed in Table 3.3.2-30 with an environment of "Reactor Coolant (internal)." (4) The segment of pipe from the outboard containment isolation check valve, to the reactor vessel is at greater than 140 °F in a reactor coolant (internal) environment and, therefore, would be subject to cracking and loss of material. These stainless steel items are addressed in Table 3.3.2-30 under component types, "Pipe Class 1, pipe fittings, tubing" and "Valve Class 1" with Aging Effects Requiring Management of Cracking and Loss of Material.

Based on this information, the staff finds the applicant's response to RAI 3.3.2.2.3.1-1 acceptable. The staff's concern described in RAI 3.3.2.2.3.1-1 is resolved.

Based on the program identified, the staff concludes that the applicant's program meets SRP–LR Section 3.3.2.2.3.1 criteria. For those line items that apply to LRA Section 3.3.2.2.3.1, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) LRA Section 3.3.2.2.3.2 addresses cracking due to SCC in stainless steel or stainless steel clad heat exchanger components exposed to treated water greater than 140 °F. The applicant stated that cracking due to SCC in stainless steel and stainless steel clad

heat exchanger components in a treated water environment greater than 140 °F will be managed by the Water Chemistry Program and the effectiveness verified by the One-Time Inspection programs.

The staff reviewed LRA Section 3.3.2.2.3.2 against the criteria described in SRP-LR Section 3.3.2.2.3.2, which states that cracking due to SCC could occur in stainless steel and steel with stainless steel cladding heat exchanger components exposed to treated water greater than 60 °C (greater than 140 °F). The GALL Report, under item VII.E3-3, recommends managing the aging effect using a plant-specific AMP.

The staff reviewed the LRA and identified in Table 3.3.1, item 3.3.1-5 that the applicant will use the Water Chemistry and One-Time Inspection programs to manage the cracking due to SCC for these particular components. The staff also reviewed the applicant's Water Chemistry and the One-Time Inspection programs, which are evaluated in SER Sections 3.0.3.1.26 and 3.0.3.1.21, respectively. The applicant stated that the One-Time Inspection Program includes identification of inspection locations based on the most susceptible to the potential corrosion mechanism, selection of the examination technique with acceptance criteria, and evaluation of the results including the need for additional inspections or other corrective actions. The staff finds that the credited programs are appropriate because: (1) the Water Chemistry Program will establish the plant water chemistry control parameters and identify the actions required if the parameters exceed limits and (2) the One-Time Inspection Program will include a one-time inspection of select components to verify the effectiveness of the Water Chemistry Program for managing the effects of aging due to the potential corrosion mechanisms. The staff also finds the applicant's management of the effect of aging acceptable because it requires inspections at appropriate locations (e.g., stagnant low flow). The staff finds that the applicant satisfied the acceptance criteria in SRP-LR Section 3.3.2.2.3.2 and, therefore, the applicant's AMR results are consistent with the one under GALL Report item VII.E3-3.

Based on the program identified, the staff concludes that the applicant's program meets SRP–LR Section 3.3.2.2.3.2 criteria. For those line items that apply to LRA Section 3.3.2.2.3.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(3) LRA Section 3.3.2.2.3.3 addresses cracking due to SCC could occur in stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust. The applicant stated that the stainless steel diesel exhaust components exposed to diesel exhaust are normally in the standby mode of operation and do not have temperatures >140^0 F.

The staff reviewed LRA Section 3.3.2.2.3.3 against the criteria in SRP-LR Section 3.3.2.2.3.3, which states that cracking due to SCC could occur in stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed.

The staff requested clarification from the applicant by electronic mail on March 8, 2010 of the rationale of being in standby mode of operation with respect to cracking of these stainless steel components exposed to diesel exhaust and that although the duration of exposure is short, that excluding these components from aging management is inconsistent with the recommendations of the GALL Report.

By letter dated April 2, 2010, the applicant amended LRA Section 3.3.2.2.3.3 and LRA Table 3.3.1, Item 3.3.1-6 to state that its Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will managing cracking due to stress corrosion cracking in stainless steel piping components exposed to diesel exhaust in the standby diesel generator system.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Sections 3.0.3.1.20. The staff determined that this program includes periodic inspection that are performed during existing pre-planned periodic system and component maintenance activities when the systems are opened and the surfaces are made accessible for inspection. The staff also determined that this maintenance may occur during power operations or during refueling outages when many systems are opened and the inspections assure that existing environmental conditions are not causing material degradation that could result in a loss of the component intended functions. The staff noted that this program will perform a VT-1 inspection based on the applicant's procedure that includes program requirements, equipment, visual aids, examination standards, and acceptance standards. The staff determined that based on the recommendations of the GALL Report a VT-1 examination is capable of detecting cracking due to stress corrosion cracking and is therefore acceptable. Based on its review, the staff finds the applicant's use of its Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable because it will perform periodic VT-1 inspections of the stainless steel components exposed to diesel exhaust (internal) which is capable of detecting cracking due to stress corrosion cracking in these components.

Based on the program identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.3.3 criteria. For those line items that apply to LRA Section 3.3.2.2.3.3, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the above, the staff concludes that the applicant meets SRP-LR Section 3.3.2.2.3 criteria. The staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.4 Cracking Due to Stress Corrosion Cracking and Cyclic Loading

The staff reviewed LRA Section 3.3.2.2.4 against the following criteria in SRP-LR Section 3.3.2.2.4:

(1) LRA Section 3.3.2.2.4.1 addresses cracking due to SCC and cyclic loading in stainless steel PWR nonregenerative heat exchanger components exposed to treated borated water greater than 60 °C (140 °F) in the chemical and volume control system. The applicant stated that this aging effect is not applicable because DAEC is a BWR plant.

SRP-LR Section 3.3.2.2.4.1 states that cracking due to SCC and cyclic loading may occur in stainless steel PWR nonregenerative heat exchanger components exposed to treated borated water greater than 60 °C (140 °F).

The staff concludes that the recommendations in SRP-LR 3.3.2.2.4.1 are not applicable because DAEC is not a PWR designed reactor.

(2) LRA Section 3.3.2.2.4.2 addresses cracking due to SCC and cyclic loading in stainless steel PWR regenerative heat exchanger components exposed to treated borated water greater than 60 °C (140 °F). The applicant stated that this aging effect is not applicable because DAEC is a BWR plant.

SRP-LR Section 3.3.2.2.4.2 states that cracking due to SCC and cyclic loading may occur in stainless steel PWR regenerative heat exchanger components exposed to treated borated water greater than 60 °C (140 °F).

The staff concludes that the recommendations in SRP-LR 3.3.2.2.4.2 are not applicable because DAEC is not a PWR designed reactor.

(3) LRA Section 3.3.2.2.4.3 addresses cracking due to SCC and cyclic loading in the stainless steel pump casing for the PWR high-pressure pumps in the chemical and volume control system. The applicant stated that this aging effect is not applicable because DAEC is a BWR plant.

SRP-LR Section 3.3.2.2.4.3 states that cracking due to SCC and cyclic loading may occur in the stainless steel pump casing for the PWR high-pressure pumps in the chemical and volume control system

The staff concludes that the recommendations in SRP-LR 3.3.2.2.4.3 are not applicable because DAEC is not a PWR designed reactor.

The staff concludes that the recommendations in SRP-LR 3.3.2.2.4 are not applicable because DAEC is not a PWR designed reactor.

3.3.2.2.5 Hardening and Loss of Strength Due to Elastomer Degradation

The staff reviewed LRA Section 3.3.2.2.5 against the following criteria in SRP-LR Section 3.3.2.2.5:

(1) LRA Section 3.3.2.2.5.1 addresses the applicant’s aging management basis for managing hardening and loss of strength due to elastomer degradation in elastomer seals and components in the heating and ventilation systems exposed to air-indoor uncontrolled (internal or external). In the LRA the applicant stated that at its nuclear plant elastomer flexible connections in the heating and ventilation systems exposed to air- uncontrolled (internal or external) are periodically replaced. In LRA Table 3.3-1, item 3.3.1-11, the applicant stated that the item is not applicable.

The staff reviewed LRA Section 3.3.2.2.5.1 against the criteria in SRP-LR Section 3.2.2.2.5.1, which states that hardening and loss of strength due to elastomer degradation could occur in elastomer seals and components of heating and ventilation systems exposed to air-indoor uncontrolled. The SRP-LR also states that the GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

SRP-LR Section 3.3.2.2.5.1 references AMR item 11 in Table 3 of the GALL Report, Volume 1, and GALL AMR items VII.F1-7, VII.F2-7, VII.F3-7, and VII.F4-6, all of which are related to generic item A-17, for elastomer seals and components exposed to air-indoor, uncontrolled in the control room area ventilation system, the auxiliary and radwaste ventilation system, the primary containment heating and ventilation system, and the diesel generator building ventilation system, respectively.

The staff noted that, in accordance with 10 CFR 54.21(a)(1)(ii), periodic replacement of in-scope components affected by aging is an acceptable alternative to managing the aging effect with an AMP. However, the staff found that information provided in the LRA was not sufficient to determine whether the applicant's proposed periodic component replacement provides adequate assurance that the component will continue to perform its intended function during the period of extended operation. By letter dated November 13, 2009, the staff issued RAI 3.3.2.2.5.1-01 requesting the applicant provide additional information with regard to the basis for periodic replacement of these components.

In its response dated December 14, 2009, the applicant stated that replacement periodicity is based on plant operating experience, previous component examinations, engineering judgment, and replacement periodicity for similar components. The applicant further stated that it has assigned a replacement periodicity of 16 years for heating and ventilation system flexible elastomer components that are in-scope for license renewal. The applicant stated that this is a reasonable, conservative replacement frequency to ensure that the components' intended functions are maintained during the period of extended operation. The applicant further stated that system engineers monitor heating and ventilation system elastomer components for cracking, flexibility, and overall component condition as part of their system walkdowns and that recent examinations of the entire exposed surface, both visually and using physical manipulation, have confirmed that heating and ventilation elastomer components are not degraded, are installed correctly, and are in good physical condition. The applicant also stated that review of its operating experience found that no age-related degradation has been identified for heating and ventilation system elastomer components exposed to an air-indoor uncontrolled (internal or external) environment.

Based on its review, the staff finds the applicant's response to RAI 3.3.2.2.5.1-01 acceptable because it provides a specific, replacement frequency for elastomer seals and components in heating and ventilation systems that are within the scope of license renewal. The staff noted that the applicant has based the selected replacement period on plant-specific operating experience and previous components examinations and that the applicant has recently completed examinations that confirm adequacy of its selected elastomer seal and component replacement periodicity. The staff's concern described in RAI 3.3.2.2.5.1-01, is resolved.

On the basis that the applicant provides periodic replacement of all elastomer seals and connections in the heating and ventilation systems within the scope of license renewal, as described in its response to RAI 3.3.2.2.5.1-01, the staff finds it acceptable for the applicant to designate LRA Table 3.3-1, item 3.3.1-11 as not applicable.

(2) LRA Section 3.3.2.2.5.2 addresses the applicant's aging management basis for managing hardening and loss of strength due to elastomer degradation in elastomer linings of filters, valves, and ion exchangers in spent fuel pool cooling and cleanup systems exposed to treated water or treated borated water. In the LRA the applicant stated that no credit is taken for any elastomer linings to prevent loss of material from the underlying carbon steel material, and that the material is identified as carbon steel for the AMR.

The staff reviewed LRA Section 3.3.2.2.5.2 against the criteria in SRP-LR Section 3.2.2.2.5.2, which states that hardening and loss of strength due to elastomer degradation could occur in elastomer linings of filters, valves, and ion exchangers in spent fuel pool cooling and cleanup systems (BWR and PWR) exposed to treated water or to treated borated water. The SRP-LR also states that the GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

SRP-LR Section 3.3.2.2.5.2 references AMR item 12 in Table 3 of the GALL Report, Volume 1, and, for BWRs, GALL AMR items VII.A4-1 (generic item A-16) for elastomer linings exposed to treated water in the spent fuel pool cooling and cleanup system.

The staff noted that AMR results in LRA Table 3.3.2-12 for the fuel pool cooling and cleanup system do not include any elastomer-lined components, and that this is consistent with the applicant's claim that no credit is taken for elastomer linings to prevent loss of material from the underlying carbon steel material.

On the basis that the applicant does not take credit for elastomer linings to prevent aging effects in carbon steel components in the fuel pool cooling and cleanup system, the staff finds it acceptable for the applicant to designate LRA Table 3.3-1, item 3.3.1-12 as not applicable.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.5 criteria. For those line items that apply to LRA Section 3.3.2.2.5, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.6 Reduction of Neutron-Absorbing Capacity and Loss of Material Due to General Corrosion

The staff reviewed LRA Section 3.3.2.2.6 against the criteria in SRP-LR Section 3.3.2.2.6.

LRA Section 3.3.2.2.6 addresses reduction of neutron-absorbing capacity and loss of material due to general corrosion. The applicant stated that these aging effects are not applicable because Boral, the neutron-absorbing medium, does not degrade as a result of long-term exposure to radiation, and Boral is stable, durable, and corrosion resistant.

SRP-LR Section 3.3.2.2.6 states that reduction of neutron-absorbing capacity and loss of material due to general corrosion may occur in the neutron-absorbing sheets of BWR and PWR spent fuel storage racks exposed to treated water or treated borated water. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

The staff reviewed LRA Section 3.3.2.2.6 against the staff's recommended regulatory criteria in SRP-LR Section 3.3.2.2.6 and in GALL AMR item VII.A2-3.

In the original application, the staff reviewed LRA Section 3.3.2.2.6 in which the applicant evaluated if a reduction of neutron-absorbing capacity might occur in the neutron-absorbing sheets of the spent fuel storage racks at DAEC due to general corrosion. The staff questioned the rationale provided by the applicant. In RAIs dated September 24, 2009, the staff requested that the applicant provide additional details on neutron-absorbing materials in the spent fuel pool.

The applicant responded to the RAIs in a letter dated October 23, 2009. The staff reviewed the information provided in the applicant's response to the RAIs and needed additional clarification. The staff held conference calls with the applicant on November 12, 2009, and December 3, 2009, to clarify the responses to the RAIs.

After the conference calls, the applicant made a commitment to LRA Appendix A, Section 18.4, Commitment No. 48, in a letter dated January 14, 2010, that DAEC will, "Implement a Boral Surveillance Program and complete the first in-situ neutron attenuation test of the PaR [Programmed and Remote] spent fuel racks."

The applicant stated that this commitment is scheduled to be implemented, "Prior to entering the period of extended operation." The applicant also stated, "A follow-up test will be performed at a date to be determined based on the results of the baseline test and relevant industry experience, but not to exceed 10 years after the baseline test."

In addition to the Commitment, in the January 14, 2010, letter, the applicant amended its application as described below. This revision included the addition of a new Section B.3.41, "Boral Surveillance Program," in LRA Appendix B. The program description stated:

> The Boral material managed by this program is incorporated in the spent fuel storage rack design to assist in controlling spent fuel pool reactivity. It is described as a uniformly dispersed mixture of boron carbide (B4C) and aluminum powders, clad in aluminum sheets, and hot rolled to produce an integral three layer panel.
>
> The Boral surveillance program consists of representative coupon testing for the Holtec racks and in-situ neutron attenuation testing for the Programmed and Remote (PaR) racks. This program will ensure the assumptions of the fuel pool criticality analysis will continue to be met during the period of extended operation.

The applicant's "Boral Surveillance Program" addresses the program attributes that an AMP in the GALL Report would contain. This program is a plant-specific AMP described in its updated LRA.

The scope of the program consists of periodic coupon testing for DAEC's Holtec racks and in-situ neutron attenuation testing for the PaR racks. The DAEC Boral Surveillance Program includes inspections and evaluations of those inspections, but it does not provide guidance on methods to mitigate aging of the Boral material nor does it contain any other preventative actions. The DAEC Boral Surveillance Program monitors changes in physical properties of the Boral in the Holtec racks by performing measurements and testing of Boral coupon samples on a pre-planned schedule. These measurements include: visual observation and photography, neutron attenuation and radiography, dimensional measurements (length, width, and thickness), weight, and specific gravity measurements. For the PaR racks, the neutron absorption capacity of the racks is tested through in-situ neutron attenuation tests. The above tests for Holtec and PaR racks provide insight on the detection of aging effects, and confirm that the Boral neutron absorber panels continue to meet the assumptions of the spent fuel pool criticality analysis. The DAEC Boral Surveillance Program monitors and trends any degradation of the Boral coupons in the Holtec racks by comparing the as-found parameters of the coupon with the as-installed parameters. The program requires removal and testing of a coupon prior to every third RFO. For the PaR racks, a baseline in-situ neutron attenuation test will be performed prior to the period of extended operation to determine the Boral areal density, and the results will be used during subsequent in-situ neutron attenuation tests to confirm that the Boral panels continue to meet the assumptions of the spent fuel pool criticality analysis. A follow-up test will be performed at a date to be determined based on the result of the baseline test and relevant industry experience, but not to exceed 10 years after the baseline test.

The Boral Surveillance Program compares the as-found parameters and the original coupon parameters of the Boral in the Holtec racks. A decrease of no more than 5 percent in Boron-10 (B-10) content as determined by neutron attenuation is acceptable. An increase in thickness at any point shall not exceed 10 percent of the initial thickness at that point. For the Boral in the PaR racks, in-situ neutron attenuation testing will be performed to confirm that the Boral panels continue to meet the assumptions of the spent fuel pool criticality analysis. The confirmation process and administrative controls requirements for both the Holtec and PaR racks are met by the FPL Quality Assurance Program as described in FPL-1 Quality Assurance Topical Report. Industry operating experience has identified several instances of blistering in Boral coupons. DAEC has not identified blistering to be an issue with its coupons, and it has not identified any defects to date. There is no comparable industry operating experience indicating loss of areal density of B-10 in Boral that would apply to the PaR racks. The in-situ neutron attenuation testing of the PaR racks is intended to confirm that no degradation is occurring which would cause the racks to not meet the assumptions of the spent fuel pool criticality analysis.

On January 22, 2010, the staff held a conference call with the applicant to clarify staff concerns regarding the consistency of the "corrective actions" element of the Boral Surveillance Program relative to similar AMPs in the GALL Report. In a letter dated February 2, 2010, the applicant responded to the staff's concerns. The staff has reviewed the applicant's response, and found the response to be consistent with similar AMPs in the GALL Report for the "corrective actions" element of the Boral Surveillance Program.

The staff compared the new program to the 10 elements of an AMP. The staff finds the scope of the Boral Surveillance Program acceptable since both types of racks, Holtec and PaR, are included in the program. There are no preventative actions in the Boral Surveillance Program; however, since this program is intended to be a condition monitoring program, no preventative actions are required and, therefore, the staff finds this element of the Boral Surveillance Program acceptable. The staff finds acceptable the parameters monitored for the Holtec racks because these parameters (visual observation, neutron attenuation, dimensions, weight, and specific gravity) are intended to discover any changes in physical properties in the coupon samples that would be indicative of degradation of the Boral material and/or loss of B-10. The staff also finds acceptable the parameter monitored for the PaR racks (neutron absorption capacity) because it will ensure that changes in neutron absorption capacity of the PaR racks will be detected. The detection of aging effects and monitoring and trending of Boral in the Holtec racks is acceptable because the Boral Surveillance Program compares the as-found condition of Boral coupons in the Holtec racks to the as-installed condition such that degradation of the Boral will be seen in a reasonable amount of time (coupon inspections are performed every third RFO). In addition, the detection of aging effects and monitoring and trending of Boral in the PaR racks is acceptable because the applicant will be performing a baseline neutron attenuation test prior to the period of extended operation and subsequent neutron attenuation tests will be compared to the baseline to look for any changes in neutron attenuation in the PaR racks. The first follow-up neutron attenuation test is to be performed no more than 10 years after the baseline test.

The staff finds the acceptance criteria of the Boral Surveillance Program acceptable because the program looks for changes in B-10 content as well as Boral thickness in the Holtec racks, both of which may be indications of Boral degradation and/or loss of neutron absorption capacity of the Holtec racks. For the PaR racks, the staff finds the acceptance criteria acceptable because the neutron attenuation testing will be performed to confirm that the Boral panels in the PaR racks continue to meet the assumptions of the spent fuel pool criticality analysis. The staff finds the corrective actions acceptable for both the Holtec and the PaR racks because corrective actions will be initiated if the Boral Surveillance Program acceptance criteria are violated. The staff finds the confirmation process and administrative controls for both the Holtec and PaR racks acceptable because the applicant has quality assurance (QA) procedures, site review and approval processes, and administrative controls that are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. The staff finds the applicant’s incorporation of operating experience into the Boral Surveillance Program acceptable. The applicant has not seen to date any changes of neutron absorption capacity or dimensions in the Holtec coupons. The applicant also notes that industry operating experience has identified several instances of blistering in Boral coupons; however, DAEC has not seen blistering in its Holtec coupons to date. There is no comparable industry operating experience, or DAEC operating experience, indicating loss of areal density of B-10 in Boral that would apply to the PaR racks, but the applicant has committed to perform in-situ neutron attenuation testing to confirm that no degradation is occurring that would cause the PaR racks to not meet the assumptions of the spent fuel pool criticality analysis. In addition, the staff notes that bulging may occur in periods between in-situ testing of the spent fuel pool racks, and that the applicant has a means to find significant bulges during routine activities and maintenance.

The applicant made a commitment to LRA Appendix A, Commitment No. 48 in the letter dated January 14, 2010, “Implement a Boral Surveillance Program and complete the first in-situ neutron attenuation test of the PaR spent fuel racks.”

The applicant stated that this commitment is scheduled to be implemented “Prior to entering the period of extended operation.” The applicant also stated, “A follow-up test will be performed at a date to be determined based on the results of the baseline test and relevant industry experience, but not to exceed 10 years after the baseline test.”

This is found to be acceptable by the staff since it gives reasonable assurance that the neutron-absorbing capacity will be adequately managed in the period of extended operation.

The staff reviewed the applicant's application, responses to RAIs, and the commitment and concludes that the applicant's responses and programs meet SRP-LR Section 3.3.2.2.6 criteria. For those line items that apply to LRA Section 3.3.2.2.6, the staff concludes that the LRA is consistent with the GALL Report and the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the above, the staff concludes that the applicant meets SRP-LR Section 3.3.2.2.6 criteria. The staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.7 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.3.2.2.7 against the following criteria in SRP-LR Section 3.3.2.2.7:

(1) LRA Section 3.3.2.2.7.1 refers to Table 3.3-1, items 3.3.1-14, 15, and 16, and addresses loss of material due to general, pitting, and crevice corrosion in steel piping, piping components, and piping elements, including the tubing, valves, and tanks in the reactor coolant pump oil collection system, exposed to lubricating oil. The LRA states that the loss of material due to general, crevice, and pitting corrosion is managed by the Lubricating Oil Analysis Program that includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion and the effectiveness of the Lubricating Oil Analysis Program will be confirmed by the One-Time Inspection Program where selected components, including a sample of components where potential water pooling will occur, are inspected to ensure corrosion does not occur. The applicant stated that these line items are not applicable because it is a BWR with an inert containment atmosphere and with no reactor coolant pump oil collection system.

Based on its review of the LRA, the staff confirmed that the applicant is a BWR with an inert containment atmosphere and has no reactor coolant pump oil collection system. The staff finds the applicant's determination that LRA Table 3.3.1, line items 15 and 16 are not applicable acceptable.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.7.1 criteria. For those line items that apply to LRA Section 3.3.2.2.7.1, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) LRA Section 3.3.2.2.7.2 refers to Table 3.3-1, item 3.3.1-17 and addresses steel piping and components exposed to treated water. The LRA states that these components are managed for loss of material due to general, crevice, and pitting corrosion by the Water Chemistry Program and 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, including susceptible locations such as areas of stagnant flow.

The staff reviewed LRA Section 3.3.2.2.7.2 against the criteria in SRP-LR Section 3.3.2.2.7.2, which states that loss of material due to general, pitting, and crevice corrosion could occur in steel piping, piping components, and piping elements in the BWR reactor water cleanup and shutdown cooling systems exposed to treated water. The staff noted that the SRP-LR states that the existing AMP relies on monitoring and control of 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 locations of stagnant flow conditions could cause general, pitting, or crevice corrosion and, therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion does not occur. The GALL Report recommends further evaluation of programs to manage loss of material from general, pitting, and crevice corrosion to verify the effectiveness of the Water Chemistry Program. The GALL report recommends that a one-time inspection of select components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that the component's intended function will be maintained during the period of extended operation.

The staff reviewed the LRA AMR line items associated with item 3.3.1-17 and noted that for items that are consistent with the GALL Report item for material, environment, and aging effect, but a different AMP is credited (generic note E), the applicant credited the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program in LRA Tables 3.3.2-6, 3.3.2-18, 3.3.2-23, and 3.3.2-28 for loss of material of steel components exposed to treated water. The GALL Report, items VII.E3-18 and VII.E4-17, recommends the use of the Water Chemistry Program augmented by the One-Time Inspection Program to manage this aging effect. By letter dated January 6, 2010, the staff issued RAI BF76-4 requesting that the applicant justify the effectiveness of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program in managing the aging effect of loss of material due to general, pitting, and crevice corrosion in the identified steel components exposed to treated water.

In its response dated February 2, 2010, the applicant stated that while some of the specific components are exposed to treated water, none are exposed to reactor coolant grade water and as such, the Water Chemistry Program is not applicable. The applicant also stated that its Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program includes: (1) established visual examination techniques for the detection of loss of material due to corrosion and loss of material due to fouling, (2) inspections are performed at a frequency sufficient for the detection of aging effects prior to the loss of component intended function, (3) the presence of corrosion or fouling on the internal surfaces of metallic materials will be identifiable as surface discontinuities and imperfections or localized discoloration (surface discontinuities include indications such as rust, scale/deposits (debris), pitting, and coating degradation), (4) for painted or coated surfaces, the visual inspections will confirm the integrity of the coating as a method to manage the effects of corrosion of the underlying metal surface, and (5) inspection locations will be chosen to include conditions that create the potential for the aging effects of concern (e.g., stagnant and/or low flow locations). The staff finds that the applicant's use of the Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable because it requires inspections at appropriate frequencies and locations, and the inspections will detect loss of material prior to the component's intended function not being met in the period of extended operation. The staff's concern in RAI BF76-4 is resolved.

The staff reviewed the applicant's Water Chemistry Program and One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.1.26 and 3.0.3.1.21, respectively. The staff finds that these programs: (1) provide for periodic sampling of treated water to maintain contaminants at acceptable limits to preclude loss of material due to general, pitting, and crevice corrosion, and (2) will perform one-time inspections of select steel piping, piping components, and piping elements exposed to treated water for loss of material due to general, pitting, and crevice corrosion to verify the effectiveness of the Water Chemistry Program in applicable auxiliary systems. The staff noted that the applicant is crediting the Water Chemistry Program as recommended in GALL AMR item VII.E3-18 and the applicant is verifying effectiveness of the Water Chemistry Program with the elements of the One-Time Inspection Program, which the GALL Report states is an acceptable program to verify the Water Chemistry Program's effectiveness. Therefore, the staff finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.7.2.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.7.2 criteria. For those line items that apply to LRA Section 3.3.2.2.7.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(3) LRA Section 3.3.2.2.7.3 addresses loss of material due to general, pitting, and crevice corrosion in diesel exhaust piping, piping components, and piping elements. The applicant stated that loss of material due to general corrosion for steel piping components exposed to diesel exhaust is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. Loss of material due to corrosion was not identified as an applicable aging effect for the stainless steel diesel exhaust piping flexible connections and tubing which are located inside the diesel generator buildings. The diesel exhaust system is normally in standby mode and the inside surfaces of the components are dry and not subject to any type of wetting.

SRP-LR Section 3.3.2.2.7.3 states 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.

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Sections 3.0.3.1.20. SRP-LR Section 3.3.2.2.7.3 references AMR item 18 in Table 3 of the GALL Report, Volume 1, and AMR item VII.H2-2 in the GALL Report, Volume 2, as applicable to stainless steel and steel diesel engine exhaust piping in the emergency diesel generator system. The GALL Report, under item VII.H2-2 recommends that a plant-specific program be credited to manage loss of material due to general (steel only), pitting, and crevice corrosion for steel and stainless steel piping, piping components, and piping elements in an environment of diesel exhaust. The staff confirmed that only piping, fittings, hoses, tubes, and rupture disks that align to GALL AMR item VII.H2-2 for the auxiliary system – diesel generator and support system that are fabricated from steel and stainless steel materials are applicable.

The applicant stated that its new Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will perform inspections of the internal surfaces of steel piping, piping components, ducting, and other components that are not covered by other AMPs. The applicant also stated that the program inspections are inspections of opportunity, performed during the existing preplanned periodic system and component maintenance activities when the systems are opened and the surfaces are made accessible for visual inspection.

The staff noted that the applicant is crediting this program to perform inspections of steel piping and piping components. The staff also noted that the applicant is crediting this program for internal surfaces of steel and stainless steel material as identified in LRA Table 3.3.2-29. The applicant stated that its new Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is consistent with GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," with no exceptions or enhancements. However, the staff noted that GALL AMP XI.M38 only addresses steel material. The staff determined that additional information was needed to complete its review. By letter dated November 13, 2009, the staff issued RAI 3.3.2.2.7-1 requesting that the applicant justify why the inclusion of stainless steel material in the scope of the program is not considered an exception or an enhancement to GALL AMP XI.M38. The staff also requested that the applicant provide the acceptance criteria it proposes to use for detecting loss of material in stainless steel material.

In its response dated December 14, 2009, the applicant stated that the program description of GALL AMP XI.M38 states that the program consists of inspections of the internal surfaces of steel piping, piping components, ducting, and other components that are not covered by other AMPs. The applicant also stated that the concept behind this program is to provide an inspection program for miscellaneous components subject to loss of material that do not fit within other AMPs, and that the program, as designed, is fully applicable to components of various materials; its effectiveness as an AMP is not limited to carbon steel. The applicant further stated that, consistent with this definition, it has applied this program to manage loss of material in metallic components such as steel, stainless steel, copper alloy, nickel alloy, and aluminum alloy. The applicant also stated that based on the definition of exceptions or enhancements as defined in SRP-LR Section 3.0.1, the applicant does not consider the application of this program to other metallic components besides steel to be an exception or an enhancement.

The applicant also stated that the presence of corrosion or fouling on the internal surface of metallic components will be identifiable as surface discontinuities such as rust, scale/deposits, pitting, and coating degradation and imperfections or localized discoloration. The applicant further stated that inspections are conducted on a periodic basis and inspection locations are chosen to include conditions susceptible to the aging effects of concern.

The staff reviewed the applicant's response to the RAI and finds it acceptable because the applicant has appropriately identified the inspection criteria, inspection interval, and inspection locations to adequately manage the aging effects of stainless steel components. The staffs concern described in RAI 3.3.2.2.7-1 is resolved.

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).

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.7 criteria. For those line items that apply to LRA Section 3.3.2.2.7, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.8 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion

LRA Section 3.3.2.2.8 addresses loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion which could occur for steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil. The applicant stated that loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion for steel components with an external environment of soil is being managed by the Buried Piping and Tanks Inspection Program. The applicant also stated that the Buried Piping and Tanks Inspection Program 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 3.3.2.2.8 against the criteria in SRP-LR Section 3.3.2.2.8, which states that loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion could occur for steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil. The GALL Report states that the Buried Piping and Tanks Inspection Program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, crevice, and microbiologically-influenced corrosion. The GALL Report also states that the effectiveness of the Buried Piping and Tanks Inspection Program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material does not occur.

The staff reviewed the applicant's Buried Piping and Tanks Inspection Program and its evaluation is documented in SER Section 3.0.3.1.7.

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 (generic note A) or are consistent with the GALL Report in all respects except that a different AMP is credited (generic note E).

In its review of components subordinate to LRA item 3.3.1-19, for which the applicant assigned generic note E, the staff noted that the components under consideration are closure bolts. The staff accepts the applicant's proposal that these components can be addressed under the Bolting Integrity Program because these bolts are within the scope of the program and the program contains appropriate inspection guidance for these bolts including loss of material due to corrosion and loss of preload.

The GALL Report recommends further evaluation of the effectiveness of the applicant's Buried Piping and Tanks Inspection Program based on its operating history. In its audit of the applicant's Buried Piping and Tanks Inspection Program, the staff found no operating history which would indicate a need for a change to the Buried Piping and Tanks Inspection Program. The staff finds that the LRA AMP is sufficient to adequately manage the aging of steel because it contains appropriate inspection procedures to visually examine the exterior surfaces of the steel piping for loss of material due to pitting or crevice corrosion at intervals consistent with the GALL Report AMP. The LRA AMP satisfies the acceptance criteria in SRP-LR 3.3.2.2.8 and, therefore, the applicant's AMR results are consistent with the ones under GALL Report item VII.C1-18.

Based on the programs identified above, 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, as required by 10 CFR 54.21(a)(3).

3.3.2.2.9 Loss of Material Due to General, Pitting, Crevice, Microbiologically-Influenced Corrosion and Fouling

The staff reviewed LRA Section 3.3.2.2.9 against the criteria in SRP-LR Section 3.3.2.2.9:

(1) LRA Section 3.3.2.2.9.1 refers to Table 3.3-1 item 3.3.1-20 and addresses carbon steel piping, piping components, piping elements, and tanks exposed to fuel oil. The LRA states that these components are managed for loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion by the Fuel Oil Chemistry Program. The applicant further stated that the effectiveness of the Fuel Oil Chemistry Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program, and that the program includes periodic sampling and analysis of fuel oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion.

The staff reviewed LRA Section 3.3.2.2.9.1 against the criteria in SRP-LR Section 3.3.2.2.9.1, which states that loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion and fouling could occur for steel piping, piping components, piping elements, and tanks exposed to fuel oil. SRP-LR Section 3.3.2.2.9.1 further states that: (1) the existing AMP relies on the fuel oil chemistry program for monitoring and control of fuel oil contamination to manage loss of material due to corrosion or fouling, (2) corrosion or fouling may occur at locations where contaminants accumulate, and (3) the effectiveness of the fuel oil chemistry control should be verified to ensure that corrosion does not occur.

SRP-LR Section 3.3.2.2.9.1 references AMR item 20 in Table 3 of the GALL Report, Volume 1, and GALL AMR items VII.G-21 (A-28) (Fire Protection), VII.H2-24 (Emergency Diesel Generator System) and VII.H1-10 (Diesel Fuel) as applicable to loss of material due to pitting and crevice corrosion, and MIC of steel, piping, piping components, and piping elements exposed to fuel oil. These components are identified in LRA Tables 3.3.2-11, 3.3.2-28, and 3.3.2-29 as: accumulator, pulsation damper, low pressure tank, filter, screens, strainer, pipe, pipe fittings, hoses, tubes, rupture disk, pumps, positive pressure devices (except blowers), valve, damper, filter, screens, strainer.

The GALL Report recommends further evaluation of programs to manage loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion and fouling to verify the effectiveness of the Fuel Oil Chemistry Program and recommends that a one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that the component's intended function will be maintained during the period of extended operation.

The staff reviewed the applicant's Fuel Oil Chemistry and One-Time Inspection programs and its evaluations are documented in SER Sections 3.0.3.2.6 and 3.0.3.1.21, respectively. The staff finds that these programs provide for: (1) periodic sampling of fuel oil and periodic draining, cleaning, and visual inspection of fuel tanks to maintain contaminants at acceptable limits to preclude loss of material due to pitting and corrosion and (2) one-time inspections of select steel piping, piping components, piping elements, and tanks exposed to fuel oil for loss of material due to general, pitting, and crevice corrosion to verify the effectiveness of the Fuel Oil Chemistry Program in applicable auxiliary systems. However, the staff noted that the applicant does not provide a one-time inspection to verify that MIC or fouling is not active in steel piping, piping components, piping elements exposed to fuel oil. The staff noted that plant-specific note 230 of the LRA states that loss of material due to fouling does not apply to carbon steel components exposed to fuel oil that are not tanks and do not have a potential for particulate fouling (e.g., sediment, silt, dust, and corrosion products). The staff noted that the sources of fuel oil for carbon steel components exposed to fuel oil that are not tanks are various tanks where particulate and water have been present and, therefore, there is the potential that contaminants could accumulate in piping systems etc., particularly in crevices, that could promote microbial activity, MIC, and fouling. By letter dated November 13, 2009, the staff issued RAI 3.3.2.2.9-1 requesting that the applicant provide justification for not inspecting for fouling and MIC or to identify the methods to be used to verify that MIC or fouling are not active in these components.

In its response dated December 14, 2009, the applicant revised the LRA to change the text in note 230 to "Not used" and include fouling as an aging mechanism for carbon steel piping, piping components, piping elements, and tanks exposed to fuel oil. The staff finds that, as a result of these changes to the LRA, MIC and fouling of carbon steel piping, piping components, piping elements, and tanks exposed to fuel oil will be managed by the Fuel Oil Chemistry Program and the effectiveness of the program will be verified with the One-Time Inspection Program.

Based on its review, the staff finds the applicant's response to RAI 3.3.2.2.9-1 acceptable because the applicant amended its LRA so that the applicable line items are consistent with the GALL Report with regard to managing MIC and fouling of carbon steel piping, piping components, piping elements, and tanks exposed to fuel oil. The staff's concern described in RAI 3.3.2.2.9-1 is resolved.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.9.1 criteria. For those line items that apply to LRA Section 3.3.2.2.9.1, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) LRA Section 3.3.2.2.9.2 refers to Table 3.3-1, item 3.3.1-21 and addresses steel heat exchanger components exposed to lubricating oil. The LRA states that heat exchanger components are: (1) managed for loss of material due to general, pitting, and crevice corrosion and MIC by the Lubricating Oil Analysis Program; (2) the Lubricating Oil Analysis Program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion; and (3) the effectiveness of the Lubricating Oil Analysis Program will be confirmed by the One-Time Inspection Program, where selected components, including a sample of components where potential water pooling will occur, are inspected to ensure corrosion does not occur.

The staff reviewed LRA Section 3.3.2.2.9.2 against the criteria in SRP-LR Section 3.3.2.2.9.2, which states that loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion and fouling could occur for steel heat exchanger components exposed to lubricating oil. SRP-LR Section 3.3.2.2.9.2 further states that: (1) the existing AMP relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion; (2) the effectiveness of lubricating oil control should be verified to ensure that corrosion does not occur; and (3) the GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness, such as a one-time inspection of selected components at susceptible locations.

The staff reviewed the applicant's Lubricating Oil Analysis and One-Time Inspection programs and its evaluations are documented in SER Sections 3.0.3.2.8 and 3.0.3.1.21, respectively, and finds that these programs: (1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material and (2) will perform one-time inspections of select steel heat exchanger components for loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion to verify the effectiveness of the Lubricating Oil Analysis Program in applicable auxiliary systems. The staff noted that the GALL Report states that one-time inspection is an acceptable method to verify the effectiveness of a mitigative AMP such as the Lubricating Oil Analysis Program. The staff noted that the applicant is crediting the Lubricating Oil Analysis Program, as recommended in GALL AMR item VII.H2-5, and the applicant is verifying effectiveness of the Lubricating Oil Analysis Program with the elements of the One-Time Inspection Program. The staff finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.9.2.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.9.2 criteria. For those line items that apply to LRA Section 3.3.2.2.9.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.9 criteria. For those line items that apply to LRA Section 3.3.2.2.9, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.10 Loss of Material Due to Pitting and Crevice Corrosion

The staff reviewed LRA Section 3.3.2.2.10 against the following criteria in SRP-LR Section 3.3.2.2.10:

(1) LRA Section 3.3.2.2.10.1 addresses loss of material due to pitting and crevice corrosion for steel piping with either elastomer liners or stainless steel cladding exposed to treated water and treated borated water if the cladding or lining is degraded. In LRA Section 3.3.2.2.10.1 the applicant stated for auxiliary systems at its plant, no credit is taken for elastomer linings to prevent loss of material from the underlying carbon steel material when exposed to treated water. The applicant further stated that carbon steel piping and stainless steel clad components exposed to treated water are managed for loss of material due to crevice and pitting corrosion by the Water Chemistry Program, and effectiveness of the Water Chemistry Program is confirmed by the One-Time Inspection Program through an inspection of a representative sample of components, including susceptible locations, such as areas of stagnant flow. The applicant designated LRA Table 3.3.1, item 3.3.1-22 as not applicable.

The staff noted that AMR results for the applicant's auxiliary systems do not include any elastomer-lined components, and that this is consistent with the applicant's claim that no credit is taken for elastomer linings to prevent loss of material from the underlying carbon steel material. The staff also noted that carbon steel piping in the fuel pool cooling and cleanup system is evaluated as part of LRA Table 3.3-1, item 3.3.1-17, and stainless steel piping in the fuel pool cooling and cleanup system is evaluated as part of LRA Table 3.3-1, item 3.3.1-24, and that for both of these AMR result lines the applicant credits the Water Chemistry Program and the One-Time Inspection Program with managing the aging effect of loss of material.

On the basis that the applicant does not take credit for elastomer linings to prevent aging effects in carbon steel components in the fuel pool cooling and cleanup system, and the applicant evaluates carbon steel and stainless steel piping components in the fuel pool cooling and system under other appropriate AMR result lines in LRA Table 3.3.1, the staff finds it acceptable for the applicant to designate LRA Table 3.3-1, item 3.3.1-22 as not applicable.

(2) LRA Section 3.3.2.2.10.2 addresses loss of material due to pitting and crevice corrosion in stainless steel and aluminum piping, piping components, and piping elements and in stainless steel and steel with stainless steel cladding heat exchanger components exposed to treated water. The applicant stated that loss of material due to pitting and crevice corrosion in stainless steel piping and heat exchanger components in a treated water environment will be managed by the Water Chemistry and One-Time Inspection programs. The applicant also stated that the auxiliary systems have no aluminum and steel with stainless steel cladding components exposed to treated water.

The staff reviewed LRA Section 3.3.2.2.10.2 against the criteria described in SRP-LR Section 3.3.2.2.10.2, which states that loss of material due to pitting and crevice corrosion could occur for stainless steel and aluminum piping, piping components, and piping elements and for stainless steel and steel with stainless steel cladding heat exchanger components exposed to treated water. The SRP-LR also states that the AMP relies on monitoring and control of water chemistry to mitigate degradation and a one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect does not occur or is progressing very slowly such that the component's intended function will be maintained during the period of extended operation. The GALL Report, under items VII.A4-11, VII.E3-15, VII.E4-4, and VII.E4-14, recommends managing the aging effect using the Water Chemistry Program augmented by the One-Time Inspection Program to verify the effectiveness of the chemistry control program.

The staff reviewed the LRA and identified in Table 3.3.1, items 3.3.1-23 and 3.3.1-24 and noted that for items that are either fully consistent with the GALL Report (generic note A), the applicant will use the Water Chemistry and One-Time Inspection programs to manage the loss of material due to pitting and crevice corrosion for these particular components. The staff further reviewed the applicant's Water Chemistry and the One-Time Inspection programs, which are evaluated in SER Sections 3.0.3.1.26 and 3.0.3.1.21, respectively. The applicant stated that the One-Time Inspection Program includes identification of inspection locations based on the most susceptible to the potential corrosion mechanism, selection of the examination technique with acceptance criteria, and evaluation of the results including the need for additional inspections or other corrective actions. The staff finds that the credited programs are appropriate because: (1) the Water Chemistry Program will establish the plant water chemistry control parameters and identify the actions required if the parameters exceed limits and (2) the One-Time Inspection Program will include a one-time inspection of select components to verify the effectiveness of the Water Chemistry Program for managing the effects of aging due to the potential corrosion mechanisms. The staff also finds the applicant's management of the effect of aging acceptable because it requires inspections at appropriate locations (e.g., stagnant low flow). The staff finds that the applicant satisfied the acceptance criteria in SRP-LR Section 3.3.2.2.10 and, therefore, the applicant's AMR results are consistent with the ones under GALL Report items VII.A4-2, VII.A4-11, VII.E3-15, and VII.E4-14.

The staff reviewed the LRA AMR line items associated with item 3.3.1-24 and noted that for items that are consistent with the GALL Report item for material, environment and aging effect, but a different AMP is credited (generic note E), the applicant credited the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program in LRA Tables 3.3.2-6, 3.3.2-18, 3.3.2-28, 3.3.2-29, and 3.3.2-32 for loss of material due to pitting and crevice corrosion. The GALL Report, VII.E3-15 and VII.E4-14, recommends the use of the Water Chemistry Program augmented by the One-Time Inspection Program to manage this aging effect. In the applicant's reply to RAI BF76-4 (for a different AMR line item), the applicant stated that its Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program includes: (1) established visual examination techniques for the detection of loss of material due to corrosion and loss of material due to fouling, (2) inspections are performed at a frequency sufficient for the detection of aging effects prior to the loss of component intended function, (3) the presence of corrosion or fouling on the internal surfaces of metallic materials will be identifiable as surface discontinuities and imperfections or localized discoloration (surface discontinuities include indications such as rust, scale or deposits (debris), pitting, and coating degradation, (4) for painted or coated surfaces, the visual inspections will confirm the integrity of the coating as a method to manage the effects of corrosion of the underlying metal surface, and (5) inspection locations will be chosen to include conditions that create the potential for the aging effects of concern (e.g., stagnant and/or low flow locations. The staff finds that the applicant's use of the Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable because it requires inspections at appropriate frequencies and locations and the inspections will detect loss of material prior to the component's intended function not being met in the period of extended operation. The staff finds the applicant's management of the effect of aging acceptable because it requires inspections at appropriate frequencies and locations, and the inspections will detect loss of material prior to the component's intended function not being met in the period of extended operation. The staff finds that the applicant satisfied the acceptance criteria in SRP-LR Section 3.3.2.2.10.1 and, therefore, the applicant's AMR results are consistent with the GALL Report items VII.E3-15 and VII.E4-14.

In considering the suitability of the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage aging for the components under consideration, the staff noted that the LRA and GALL Water Chemistry programs are limited to high purity water (i.e., for this plant, BWR water chemistry). The staff also noted that the definition of treated water as contained in both the GALL Report and the LRA is less restrictive. It is possible to have water which meets the definition of treated water which does not meet the scope of the Water Chemistry programs. The staff further noted that the systems for which the applicant assigned generic note E are expected to contain treated water, but are not expected to contain water meeting the scope of the Water Chemistry program. The staff would normally consider this sufficient to agree with the applicant's proposal to use an AMP other than Water Chemistry. In this case, however, the staff notes that there are items in these systems where the staff does not expect high purity water (e.g., heating and ventilation systems), where the applicant proposes to manage aging through the use of the Water Chemistry program. The use of the water chemistry program for these components appears to be in conflict with the scope of the Water Chemistry AMP. Given this apparent contradiction, it was not clear whether the applicant is using the Water Chemistry program only for high purity water and the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program only for water which does not meet the criteria for use of the Water Chemistry Program.

By letter dated November 13, 2009, the staff issued RAI 3.3.2.2.10.2-1 requesting that the applicant identify the exceptions being taken to the Water Chemistry and/or One-Time Inspection AMPs and justify why such exceptions do not affect the ability of these AMPs to manage aging in the present case or to correct the generic note for these items. This RAI also requested that the applicant clarify whether the "Water Chemistry" program is being used only for items exposed to high purity water and the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is being used only to address items exposed to treated water of lesser purity and, if this is not the case, to justify the use of these programs for the specific situations being considered.

In its response dated December 14, 2009, the applicant stated that the use of generic note B was incorrect for item 3.3.1-23. The applicant further stated that the appropriate generic note was A, indicating that no exceptions to the AMPs were being taken. The applicant also confirmed that the Water Chemistry program is being used for high purity water and that the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components program is being used for components exposed to treated water of lesser quality. The staff finds the applicant's response acceptable because it resolved the issue concerning exceptions to the programs; it confirmed consistency with the GALL Report for components exposed to high purity water, and it provided a program with inspection techniques appropriate for detecting loss of material for instances in which the components under consideration were in contact with treated water of lower purity. The staff's concern described in RAI 3.3.2.2.10.2-1 is resolved.

LRA Table 3.3-1, items 3.3.1-23, and 3.3.1-24 addresses stainless steel clad and aluminum components exposed to treated water. The applicant stated that this item is not applicable because the auxiliary systems have no stainless steel clad or aluminum components exposed to treated water. The staff reviewed the UFSAR to verify the design of the auxiliary systems. Based on information in the UFSAR, the staff confirmed that the applicant's plant does not have stainless steel clad or aluminum components exposed to treated water in the auxiliary systems. Therefore, the staff finds that this item is not applicable.

Based on the program identified, the staff concludes that the applicant's program meets SRP-LR Section 3.3.2.2.10.2 criteria. For those line items that apply to LRA Section 3.3.2.2.10.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(3) In LRA Section 3.3.2.2.10.3, the applicant stated that loss of material due to pitting and crevice corrosion could occur for copper alloy HVAC piping, piping components, and piping elements exposed to condensation (external).

The applicant also stated that at DAEC, copper alloy piping, piping components, and piping elements exposed to condensation are managed for loss of material due to crevice and pitting corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant further stated that the program will visually inspect to ensure that existing environmental conditions are not causing metal degradation and that the components' intended functions are maintained during the period of extended operation.

The staff reviewed LRA Section 3.3.2.2.10.3, against the criteria in SRP-LR Section 3.3.2.2.10.3, which states that loss of material due to pitting and crevice corrosion may occur in copper alloy HVAC piping, piping components, and piping elements exposed to condensation (external). The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

SRP-LR Section 3.3.2.2.10.3 references AMR Item 25 in Table 3 of the GALL Report, Volume 1, 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, piping elements exposed to condensation (external).

The staff evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.20. The staff finds that this program requires inspections performed during the pre-planned periodic system and component maintenance activities when the systems are opened and the surfaces are made accessible for visual inspection. The staff noted that the visual inspection techniques are established and are capable of detecting loss of material due to corrosion by the presence of localized discoloration and surface irregularities such as rust, scale, deposits, surface pitting, surface discontinuities, and coating degradation.

On the basis that visual inspections performed periodically will be capable of detecting loss of material, the staff finds that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will adequately manage loss of material due to pitting and crevice corrosion of copper alloy HVAC piping, piping components, and piping elements exposed to condensation (external) through the period of extended operation.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.10.3 criteria. For those line items that apply to LRA Section 3.3.2.2.10.3, 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, as required by 10 CFR 54.21(a)(3).

(4) LRA Section 3.3.2.2.10.4 refers to Table 3.3-1, item 3.3.1-26 and addresses copper alloy piping and components exposed to lubricating oil. These components are managed for loss of material due to pitting and crevice corrosion by the Lubricating Oil Analysis Program which includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The LRA states that the effectiveness of the Lubricating Oil Analysis Program will be confirmed by the One-Time Inspection Program where selected components, including a sample of components where potential water pooling could occur, are inspected to ensure corrosion does not occur.

The staff reviewed LRA Section 3.3.2.2.10.4 against the criteria in SRP-LR Section 3.3.2.2.10.4, which states that loss of material due to pitting and crevice corrosion could occur for copper alloy piping, piping components, and piping elements exposed to lubricating oil. SRP-LR Section 3.3.2.2.10.4 further states that: (1) the GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lubricating oil program, and (2) a one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur.

SRP-LR Section 3.3.2.2.10.4 references AMR item 26 in Table 3 of the GALL Report, Volume 1, and provides for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material. The staff reviewed the applicant's Lubricating Oil Analysis and One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.8 and 3.0.3.1.21, respectively, and finds that these programs: (1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material and (2) provide for one-time inspections of select copper alloy piping, piping components, and piping elements exposed to lubricating oil for loss of material due to pitting and crevice corrosion to verify the effectiveness of the Lubricating Oil Analysis Program. The staff notes that the GALL Report states that one-time inspection is an acceptable method to verify the effectiveness of a mitigative AMP such as the Lubricating Oil Analysis Program. The staff noted that the applicant is crediting the Lubricating Oil Analysis Program as recommended in the GALL Report and the applicant is verifying effectiveness of the Lubricating Oil Analysis Program with the elements of the One-Time Inspection Program.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.10.4 criteria. For those line items that apply to LRA Section 3.3.2.2.10.4, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(5) In LRA Section 3.3.2.2.10.5 the applicant stated that loss of material due to pitting and crevice corrosion could occur for stainless steel and aluminum heating, ventilation and air conditioning piping, piping components, and piping elements exposed to condensation (internal).

The applicant stated that stainless steel HVAC components exposed to internal condensation are managed for loss of material due to crevice and pitting corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant further stated the program will visually inspect to ensure that existing environmental conditions are not causing metal degradation and that the components intended functions are maintained during the period of extended operation.

The applicant stated aluminum piping elements exposed to condensation in the safety related air system are managed for loss of material due to crevice and pitting corrosion by the Compressed Air Program. The applicant further stated the effects of corrosion and the presence of contaminants are monitored by visual inspection and periodic system and component tests, including leak rate tests on the system and individual components. Furthermore, the tests verify proper operation by comparing measured values of performance with specified performance limits which assure that the component’s intended function is maintained during the period of extended operation.

The staff reviewed LRA Section 3.3.2.2.10.5 against the criteria in SRP-LR Section 3.3.2.2.10.5, which states that loss of material due to pitting and crevice corrosion could occur for HVAC aluminum piping, piping components, and piping elements and stainless steel ducting and components exposed to condensation. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

SRP-LR Section 3.3.2.2.10 references AMR 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 applicable to stainless steel HVAC ducting and aluminum HVAC piping, piping components and piping elements exposed to condensation.

The staff evaluation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is documented in SER Section 3.0.3.1.20. The staff finds that this program requires inspections performed during the pre-planned periodic system and component maintenance activities when the systems are opened and the surfaces are made accessible for visual inspection. The staff noted that the visual inspection techniques are established and are capable of detecting loss of material due to corrosion by the presence of localized discoloration and surface irregularities such as rust, scale, deposits, surface pitting, surface discontinuities, and coating degradation. Based on its review, the staff finds that this program is capable of adequately managing loss of material due to pitting and crevice corrosion of copper alloy HVAC piping, piping components, and piping elements exposed to condensation (external) through the period of extended operation.

The staff reviewed the applicant’s Compressed Air Monitoring Program and its evaluation is documented in SER Section 3.0.3.1.14. The staff finds the applicant’s program is an existing program that manages or mitigates the aging effects of corrosion and assuring an oil free dry air environment in the instrument air system. The staff noted that this program requires monitoring and routine maintenance on the systems compressors and air dryers be performed periodically. The staff noted that the monitoring activities include a quarterly monitored blow-down along various portions of the system, a semi-annual air system quality check, and a semi-annual swapping of the instrument air dryers. Based on its review, the staff finds that this program is capbale of managing loss of material due to pitting and crevice corrosion seen in ventilation and air conditioning piping components exposed to condensation.

Based on the program identified, the staff concludes that the applicant’s program meets the criteria of SRP-LR Section 3.3.2.2.10.5 For those line items that apply to LRA Section 3.3.2.2.10.5, 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 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).

(6) LRA Section 3.3.2.2.10.6 addresses the loss of material due to pitting and crevice corrosion of copper alloy components exposed to condensation on their internal surfaces in the fire protection system and plant ventilation and standby diesel generator systems. The applicant stated that its Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will visually inspect to ensure that existing environmental conditions are not causing metal degradation and that the component's intended functions are maintained during the period of extended operation. The applicant further stated that the fire protection system does not contain copper alloy components exposed to an internal condensation environment.

The staff reviewed LRA Section 3.3.2.2.10.6 against the criteria in SRP-LR Section 3.3.2.2.10.6, which states that loss of material due to pitting and crevice corrosion could occur for copper alloy fire protection system piping, piping components, and piping elements exposed to internal condensation. The GALL Report, AMR item VII.G-9, recommends further evaluation of a plant-specific AMP to ensure that the aging effects are adequately managed.

LRA Tables 3.3.2-18 and 3.3.2-29 address the AMR items of loss of material due to pitting and crevice corrosion in the copper and copper alloy components of the plant ventilation system and standby diesel generators, respectively. The applicant also stated that the components of the AMR items are exposed to condensation (internal) and related to LRA Table 3.3-1, item 3.3.1-28 that requires further evaluation of the plant-specific AMP for the AMR items.

The staff reviewed the LRA and identified in Table 3.3-1, item 3.3.1-28 that the applicant will use the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage the loss of material due to pitting and crevice corrosion for these particular components. The staff further reviewed the applicant’s Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, which is evaluated in SER Section 3.0.3.1.20. The applicant stated that the One-Time Inspection Program includes identification of inspection locations based on the most susceptible to the potential corrosion mechanism, selection of the examination technique with acceptance criteria, and evaluation of the results including the need for additional inspections or other corrective actions. The staff notes that the GALL Report item VII.H2-21 addresses the loss of material from steel piping exposed to internal condensation and recommends use of the Inspection of Internal Surfaces in

Miscellaneous Piping and Ducting Components Program. The staff further notes that steel is more susceptible to corrosion in this environment than copper. The staff finds the use of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable because it requires periodic inspections of the component internal surfaces to ensure that existing environmental conditions are not causing material degradation and the GALL Report accepts its use in a more aggressive material and environment combination. The staff finds the applicant's management of the effect of aging acceptable because it requires inspections at appropriate frequencies and locations, and the inspections will detect loss of material prior to the component's intended function not being met in the period of extended operation. The staff finds that the applicant satisfied the acceptance criteria in SPR-LR Section 3.3.2.2.10.6 and, therefore, the applicant's AMR results are consistent with the one under the GALL Report item VII.G-9.

LRA Table 3.3-1, item 3.3.1-28 addresses loss of material due to pitting and crevice corrosion in copper alloy fire protection system piping, piping components, and piping elements exposed to internal condensation. The applicant stated that this item is not applicable because the fire protection system has no copper components exposed to internal condensation. The staff reviewed the UFSAR to verify the design of the fire protection system.

Based on information in the UFSAR, the staff confirmed that the applicant's plant does not have copper components exposed to internal condensation in the fire protection system. Therefore, the staff finds that this item is not applicable.

(7) LRA Section 3.3.2.2.10.7 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 stated that the auxiliary systems have no stainless steel components exposed to a soil environment.

The staff reviewed items subordinate to LRA Table 3.3.1, item 3.3.1-29 and noted that no subordinate items exist, nor are there any AMR line items associated with soil and stainless steel. The staff also noted that answers to staff inquiries during the aging management program audit indicated no buried stainless steel piping was present. The staff further noted that a search of the applicant's UFSAR (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

(8) LRA Section 3.3.2.2.10.8 addresses loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, and piping elements of the BWR standby liquid control system exposed to sodium pentaborate solution. The applicant stated that loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, and piping elements exposed to sodium pentaborate solution will be managed by the Water Chemistry and the effectiveness of the Water Chemistry Program will be verified by the One-Time Inspection programs.

The staff reviewed LRA Section 3.3.2.2.10.8 against the criteria described in SRP-LR Section 3.3.2.2.10.8, which states that loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements of the BWR standby liquid control system that are exposed to sodium pentaborate solution. The SRP-LR also states that the AMP relies on monitoring and control of water chemistry to mitigate degradation and a one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect does not occur or is progressing very slowly such that the component's intended function will be maintained during the period of extended operation. The GALL Report, under item VII.E2-1, recommends managing the aging effect using the Water Chemistry Program augmented by the One-Time Inspection Program to verify the effectiveness of the chemistry control program.

The staff reviewed the LRA and identified in Table 3.3-1, item 3.3.1-30 that the applicant will use the Water Chemistry and One-Time Inspection programs to manage the loss of material due to pitting and crevice corrosion for these particular components. The staff also reviewed the applicant's Water Chemistry and the One-Time Inspection programs, which are evaluated in SER Sections 3.0.3.1.26 and 3.0.3.1.21, respectively. The applicant stated that the One-Time Inspection Program includes identification of inspection locations based on the most susceptible to the potential corrosion mechanism, selection of the examination technique with acceptance criteria, and evaluation of the results including the need for additional inspections or other corrective actions. The staff finds that the credited programs are appropriate because: (1) the Water Chemistry Program will establish the plant water chemistry control parameters and identify the actions required if the parameters exceed limits, and (2) the One-Time Inspection Program will include a one-time inspection of select components to verify the effectiveness of the Water Chemistry Program for managing the effects of aging due to the potential corrosion mechanisms. The staff also finds the applicant's management of the effect of aging acceptable because it requires inspections at appropriate locations (e.g., stagnant low flow). The staff finds that the applicant satisfied the acceptance criteria in SRP-LR Section 3.3.2.2.10.8 and, therefore, the applicant's AMR results are consistent with the GALL Report, item VII.E2-1.

The staff reviewed components subordinate to LRA item 3.3.1-30, for which the applicant assigned generic note C, and noted that these items address accumulator, pulsation damper, and low pressure tank components. The staff noted that these components do not strictly meet the definition of piping, piping components, or piping elements. The staff also noted that these components are subject to loss of material from the same mechanisms and at roughly the same rate as piping such that an inspection program suitable for piping is expected to be suitable for these components. The staff finds that the components under consideration are sufficiently similar to those included in GALL Table 3.3.1, item 30 so as not to render them inconsistent with the GALL Report.

Based on the programs identified above, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.10.8 criteria. For those line items that apply to LRA Section 3.3.2.2.10.8, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the above, the staff concludes that the applicant meets SRP-LR Section 3.3.2.2.10 criteria. The staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.11 Loss of Material Due to Pitting, Crevice, and Galvanic Corrosion

LRA Section 3.3.2.2.11 addresses 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. The applicant stated its plant ventilation system contains copper alloy piping, piping components, and piping elements which are managed for crevice and pitting corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant further stated the program will visually inspect to ensure that existing environmental conditions are not causing metal degradation and that the component's intended functions are maintained during the period of extended operation.

The staff reviewed LRA Section 3.3.2.2.11 against the criteria in SRP-LR Section 3.3.2.2.11, which states that loss of material due to pitting, crevice, and galvanic corrosion could occur for copper alloy piping, piping components, and piping elements exposed to treated water. Therefore, the GALL Report recommends that the effectiveness of the water chemistry control program should be verified to ensure this aging effect does not occur. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that loss of material due to pitting and crevice corrosion does not occur and that the component’s intended function will be maintained during the period of extended operation. The staff reviewed the AMR items in comparison with SRP-LR Table 3.3-1, item 31 and GALL Report Volume 2, item VII.E3-9. In its review and comparison, the staff finds that the applicant’s consistency note is relevant for the AMR items and the credited AMP are consistent with the guidance documents.

LRA Tables 3.2.2-2 and 3.2.2-4 address the AMR items of loss of material due to pitting, crevice and galvanic corrosion in the copper alloy components of the HPCI and RCIC system. The applicant stated that the component type of the AMR items is “Heat exchanger, condenser, cooler, fan coil.” Using plant-specific note 219, the applicant stated that galvanic corrosion is not applicable to the components since it is not in contact with metal higher in the galvanic series. The applicant also stated that the consistency note for the AMR items is note C, which means that the component is different, but the material, environment, aging effect, and AMP are consistent with the GALL Report.

In LRA Table 3.3-1, item 3.3.1-31, the applicant further stated that the Water Chemistry Program is used to manage the aging effect of the AMR items and the effectiveness of the program will be confirmed by the One-Time Inspection Program. The staff reviewed the AMR items in comparison with SRP-LR Table 3.3-1, item 31 and GALL Report Volume 2, item VII.E3-9. In its review and comparison, the staff finds that the applicant’s consistency note is relevant for the AMR items and the credited aging management programs are consistent with the guidance documents.

The staff reviewed the applicant’s Water Chemistry Program and One-Time Inspection Program, and its evaluations are documented in SER Sections 3.0.3.1.26 and 3.0.3.1.21, respectively. The staff finds the applicant’s Water Chemistry Program capable of mitigating the aging effects of loss of material that can be caused by corrosion in the components of the HPCI and RCIC system in the ESF. The staff also finds that the AMP controls water chemistry to minimize the environmental degradation of the components by maintaining the relevant water chemistry and limiting the levels of contaminants that may cause loss of material. The staff finds that the One-Time Inspection Program, which performs inspections of selected components, is capable of detecting loss of material due to general, pitting, and crevice corrosion, if it should occur in the selected components, and is adequate to verify that the aging effects of loss of material are not occurring in the components so that the intended functions of the components are maintained during the extended period of operation.

The staff noted that LRA Tables 3.3.2-18 and 3.3.2-23 address the AMR items of loss of material due to pitting, crevice and galvanic corrosion in the copper and copper alloy components of the plant ventilation system and reactor building HVAC system. The applicant stated that the component types of the AMR items are “Heat exchanger, condenser, cooler, fan coil,” “Pipe, pipe fittings, hoses, tubes, rupture disk,” and “valve damper.” The applicant stated that the components are exposed to treated water (internal) and related to LRA Table 3.3-1, item 3.3.1-31 that requires further evaluation of detection of aging effects. The applicant also stated that galvanic corrosion is not applicable to the components since it is not in contact with metal higher in the galvanic series using plant-specific note 219.

The applicant stated that the consistency note for the AMR items is note E, which means that the material, environment, and aging effect are consistent with the GALL Report, but a different AMP is credited. The applicant credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

In its review, the staff noted that in comparison with the GALL Report the applicant’s aging management approach described in the LRA does not include water chemistry control to minimize adverse effects of the treated water environment on the degradation of the components. By letter dated November 13, 2009, the staff issued RAI 3.3.2.2-1 requesting that the applicant clarify whether its aging management for the AMR items includes water chemistry control to minimize adverse effects of the environment on the components. The staff also requested that if water chemistry is controlled to manage the aging effects of the AMR items the applicant should provide how the water chemistry is controlled to manage the aging effects. Furthermore, the staff also requested that if water chemistry control is not performed to minimize the environmental effect on loss of material in the components the applicant should justify why the applicant’s aging management approach without water chemistry control is adequate to manage the aging effects.

In its response dated December 14, 2009, the applicant stated the copper alloy components listed in LRA Tables 3.3.2-18 and 3.3.2-23 are piping components, valves, and heat exchanger tubes in the plant ventilation and reactor building heating systems, and the treated water used in these systems is supplied by the demineralized water systems. The applicant stated there are water chemistry controls for the purity of the make-up water and oxygen scavenging chemicals are maintained in the systems to reduce internal corrosion of the components. In comparison, the GALL AMP XI.M2 specifies the use of EPRI guidelines to maintain the water chemistry in the reactor water systems directly connected to the reactor, the feedwater, and condensate systems and the CRD system. The applicant further stated the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will visually inspect these copper alloy components to ensure that existing environmental conditions are not causing metal degradation and that the component’s intended function is maintained during the period of extended operation.

The staff noted that the applicant clarified that: (1) water chemistry controls are performed to limit the levels of contaminants that promote the aging effect of loss of material, (2) the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program includes visual inspections to ensure that the aging effects are adequately managed, and (3) the chemistry control of the treated water in the heating systems is not within the scope of GALL AMP XI.M2. The staff’s review of the Inspection of the Internal Surfaces of Miscellaneous

Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.20. In its review, the staff determines that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program can manage loss of material for the copper and copper alloy AMR items exposed to condensation because the periodic inspections of the internal surfaces of the components can detect the aging effect of the AMR items and the maintenance activities of the program can adequately maintain the intended functions of the components.

Based on its review, the staff finds that the applicant's response to RAI 3.3.2.2-1 is acceptable because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program ensures that existing environmental conditions are not causing the degradation of the components that could result in a loss of the intended function of the components and the chemistry control can prevent or mitigate the aging effect by controlling the purity of the water and using oxygen scavenging chemicals. The staff's concern described in RAI 3.3.2.2-1 is resolved.

The staff reviewed the LRA and identified in Table 3.3-1, item 3.3.1-31 that the applicant will use the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage the loss of material due to pitting, crevice, and galvanic corrosion for these particular components.

By letter dated January 6, 2010, the staff issued RAI BF76-1 requesting that the applicant justify the effectiveness of the AMP in managing the aging effect of loss of material due to pitting, crevice, and galvanic corrosion in the identified copper alloy components exposed to treated water.

In its response dated February 2, 2010, the applicant stated that: (1) the GALL Report AMP XI.M2, Water Chemistry, provides water chemistry control of reactor coolant grade water in systems which communicate with the reactor, and (2) a review of the LRA Section 3.3.2 Tables indicated that all of the copper alloy components exposed to treated water with an AMP of Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program are system components which, while exposed to treated water, are not exposed to reactor coolant; therefore, the assigned AMP differs from the GALL Report AMP because the Water Chemistry Program, as cited in the GALL Report, does not apply to the systems in which the copper alloy components are installed. The applicant also stated that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program: (1) relies on established visual examination techniques for the detection of loss of material due to corrosion and loss of material due to fouling; (2) contains inspections that are performed at a frequency sufficient for the detection of aging effects prior to the loss of component intended function; (3) the presence of corrosion or fouling on the internal surfaces of metallic materials will be identifiable as surface discontinuities (e.g., indications such as scale or deposits (debris) and pitting) and imperfections or localized discoloration; and (4) inspections are conducted on an ongoing basis at established intervals to assure timely detection of degradation, and in locations chosen to include conditions that create the potential for the aging effects of concern (e.g., stagnant and/or low flow locations). The staff finds the applicant's use of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program acceptable because it requires inspections at appropriate frequencies and locations, and the inspections will detect loss of material prior to the component's intended function not being met in the period of extended operation. The staff's concern in RAI BF76-1 is resolved.

Based on the programs identified, the staff concludes that the applicant's programs meet the criteria of SRP-LR Section 3.3.2.2.11. For those line items that apply to LRA Section 3.3.2.2.11, the staff determines that 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 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).

3.3.2.2.12 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion

The staff reviewed LRA Section 3.3.2.2.12 against the following criteria in SRP-LR Section 3.3.2.2.12:

(1) LRA Section 3.3.2.2.12.1 refers to Table 3.3-1 item 3.3.1-32 and addresses copper alloy piping, piping components, and piping elements exposed to fuel oil. The LRA states that copper alloy piping, piping components, and piping elements exposed to fuel oil are managed for loss of material due to crevice and pitting corrosion, and MIC by the Fuel Oil Chemistry Program to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion The LRA further states that the effectiveness of the Fuel Oil Chemistry Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program.

    The staff reviewed LRA Section 3.3.2.2.12.1 against the criteria in SRP-LR Section 3.3.2.2.12.1, which states that loss of material due to pitting, crevice, and microbiologically-influenced corrosion could occur in stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to fuel oil. SRP-LR Section 3.3.2.2.12.1 further states that: (1) the fuel oil chemistry program is used to control fuel oil contamination to manage the loss of material due to corrosion, (2) corrosion may occur at locations where contaminants accumulate and the effectiveness of fuel oil chemistry control should be verified to ensure that corrosion does not occur, and (3) a one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that the component's intended function will be maintained during the period of extended operation.

    The staff noted that LRA Section 3.3.2.2.12.1 states that loss of material for copper alloys exposed to fuel oil is managed using the Fuel Oil Chemistry and One-Time Inspection programs, specifically for copper alloy and bronze pipe, pipe fittings, hoses, tubes, rupture disks, and valves, exposed to fuel oil. The staff noted that these components reference plant-specific note 225, which states that crevice and pitting corrosion are not applicable aging mechanisms for copper alloy components with less than 15 percent Zn and aluminum bronze components with less than 8 percent aluminum in fuel oil and lubricating oil environments.

    Based on the staff's review, the staff determined that additional information was needed to complete its review. By letter dated November 13, 2009, the staff issued RAI 3.3.2.2.12-1 requesting that the applicant provide additional information demonstrating that crevice and pitting corrosion of bronze and copper alloys exposed to fuel oil are not applicable.

    In its response dated December 14, 2009, the applicant stated that the methodology of EPRI TR-1010639, Non Class 2 Mechanical Implementation Guideline and Mechanical Tools, Revision 4, dated January 2006, Appendix C–Lubricating Oil and Fuel Oil, was used to evaluate crevice and pitting corrosion aging mechanisms for copper alloy components in fuel oil and lubricating oil. The applicant stated that EPRI TR-1010639 indicates that copper zinc alloys with less than 15 percent Zn exhibit high resistance to crevice corrosion and pitting whereas copper zinc alloys with greater than 15 percent Zn are susceptible to pitting and crevice corrosion in oil and fuel oil; when the aluminum content of aluminum copper alloys is greater than 8 percent the aluminum is present in what is referred to as the “alpha-beta” phase, which is much less resistant to corrosion than the “alpha” phase aluminum present in bronzes containing less than 8 percent aluminum.

Based on its review, the staff finds the applicant’s response to RAI 3.3.2.2.12-1 acceptable because copper alloy and bronze with less than 15 percent Zn and aluminum bronze components are in the “alpha-beta” phase, which has increased resistance to corrosion. The staff finds that copper alloy and bronze pipe, pipe fittings, hoses, tubes, rupture disks, valves, exposed to fuel oil with less than 15 percent Zn, and aluminum bronze components with less than 8 percent aluminum in fuel oil and lubricating oil environments are not susceptible to pitting and crevice corrosion. The staff’s concern described in RAI 3.3.2.2.12-1 is resolved.

The staff reviewed the applicant’s Fuel Oil Chemistry and One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.6 and 3.0.3.1.21, respectively, and finds that these programs: (1) provide for periodic sampling of fuel oil to maintain contaminants at acceptable limits to preclude loss of material due to pitting and corrosion and (2) will perform one-time inspections of select stainless steel, aluminum and copper alloy piping, piping components, piping elements to fuel oil for loss of material due to pitting and crevice corrosion, and MIC to verify the effectiveness of the Fuel Oil Chemistry Program in applicable auxiliary systems. The staff noted that the GALL Report states that one-time inspection is an acceptable method to verify the effectiveness of mitigative AMPs. The staff noted that the Fuel Oil Chemistry Program provides for control of fuel oil contamination to mitigate loss of material due to corrosion. The staff noted that the applicant is crediting the Fuel Oil Chemistry Program as recommended in the GALL Report and the applicant is verifying effectiveness of the Fuel Oil Chemistry Program with the elements of the One-Time Inspection Program. The staff finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.12.1.

Based on the programs identified, the staff concludes that the applicant’s programs meet SRP-LR Section 3.3.2.2.12.1 criteria. For those line items that apply to LRA Section 3.3.2.2.12.1, 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).

(2) LRA Section 3.3.2.2.12.2 refers to Table 3.3-1, item 3.3.1-33 and addresses stainless steel piping and components exposed to lubricating oil. The LRA states that these components are managed for loss of material due to pitting, crevice, and MIC by the Lubricating Oil Analysis Program. The LRA further states that the Lubricating Oil Analysis Program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion and that the effectiveness of the Lubricating Oil Analysis Program will be confirmed by the One-Time Inspection Program where selected

components, including a sample of components where potential water pooling will occur are inspected to ensure corrosion does not occur.

The staff reviewed LRA Section 3.3.2.2.12.2 against the criteria in SRP-LR Section 3.3.2.2.12.2, which states that loss of material due to pitting, crevice, and microbiologically-influenced corrosion could occur in stainless steel piping, piping components, and piping elements exposed to lubricating oil. SRP-LR Section 3.3.2.2.12.2 further states that: (1) the existing program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion, and (2) the effectiveness of the lubricating oil program is verified through one-time inspection of selected components at susceptible locations to ensure that corrosion does not occur and that the component's intended function will be maintained during the period of extended operation.

The staff reviewed the applicant's Lubricating Oil Analysis Program and One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.8 and 3.0.3.1.21, respectively, and finds that these programs: (1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material and (2) will perform one-time inspections of select stainless steel piping, piping components, and piping elements exposed to lubricating oil for loss of material due to pitting, and crevice corrosion to verify the effectiveness of the Lubricating Oil Analysis Program in applicable auxiliary systems. The staff noted that the applicant is crediting the Lubricating Oil Analysis Program as recommended in the GALL Report and the applicant is verifying effectiveness of the Lubricating Oil Analysis Program with the elements of the One-Time Inspection Program, which the GALL Report states is an acceptable program to verify the Lubricating Oil Analysis Program effectiveness. Therefore, the staff finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.12.2.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.3.2.2.12.2 criteria. For those line items that apply to LRA Section 3.3.2.2.12.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the above, the staff concludes that the applicant meets SRP-LR Section 3.3.2.2.12 criteria. The staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.13 Loss of Material Due to Wear

LRA Section 3.3.2.2.13 addresses the applicant's aging management basis for managing loss of material due to wear in elastomer seals and components in the heating and ventilation systems exposed to air-indoor uncontrolled (internal or external). In the LRA the applicant stated that at its nuclear plant elastomer flexible connections in the heating and ventilation systems exposed to air-uncontrolled (internal or external) are periodically replaced. In LRA Table 3.3-1, item 3.3.1-34, the applicant stated that the item is not applicable.

The staff reviewed LRA Section 3.3.2.2.13 against the criteria in SRP-LR Section 3.2.2.2.13, which states loss of material due to wear can occur in elastomer seals and components exposed to air-indoor uncontrolled (internal or external). The SRP-LR also states that the GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed.

SRP-LR Section 3.3.2.2.13 references AMR item 34 in Table 3 of the GALL Report, Volume 1, and GALL AMR items VII.F1-5, VII.F2-5, VII.F3-5, and VII.F4-4, applicable to generic item A-73, and items VII.F1-6, VII.F2-6, VII.F3-6, and VII.F4-5, applicable to generic item A-18 elastomer seals and components exposed to air-indoor uncontrolled (external) and to air-indoor uncontrolled (internal) in the control room area ventilation system, the auxiliary and radwaste ventilation system, the primary containment heating and ventilation system, and the diesel generator building ventilation system, respectively.

The staff noted that periodic replacement of components affected by aging is an acceptable alternative to managing the aging effect with an AMP. However, the staff found that information provided in the LRA was not sufficient to determine whether the applicant's proposed periodic component replacement provides adequate assurance that the component will continue to perform its intended function during the period of extended operation. By letter dated November 13, 2009, the staff issued RAI 3.3.2.2.5.1-01 requesting the applicant provide additional information with regard to the basis for periodic replacement of these components.

In its response dated December 14, 2009, the applicant stated that replacement periodicity is based on plant operating experience, previous component examinations, engineering judgment, and replacement periodicity for similar components. The applicant further stated that it has assigned a replacement periodicity of 16 years for heating and ventilation system flexible elastomer components that are in-scope for license renewal. The applicant stated that this is a reasonable, conservative replacement frequency to ensure that the components' intended functions are maintained during the period of extended operation. The applicant further stated that its system engineers monitor heating and ventilation system elastomer components for cracking, flexibility and overall component condition as part of their system walkdowns and that recent examinations of the entire exposed surface, both visually and using physical manipulation, have confirmed that heating and ventilation elastomer components are not degraded, are installed correctly, and are in good physical condition. The applicant also stated that review of its operating experience found that no age-related degradation has been identified for heating and ventilation system elastomer components exposed to an air – indoor uncontrolled (internal or external) environment.

Based on its review, the staff finds the applicant's response to RAI 3.3.2.2.5.1-01 acceptable because it provides a specific, replacement frequency for elastomer seals and components in heating and ventilation systems that are within the scope of license renewal. The staff notes that the applicant has based the selected replacement frequency on plant-specific operating experience and previous components examinations and that the applicant has recently completed examinations that confirm adequacy of its selected elastomer seal and component replacement frequency. The staff's concern described in RAI 3.3.2.2.5.1-01 is resolved on the basis that the applicant provides periodic replacement of all elastomer seals and connections in the heating and ventilation systems within the scope of license renewal. As described in its response to RAI 3.3.2.2.5.1-01, the staff finds it acceptable for the applicant to designate LRA Table 3.3-1, item 3.3.1-34 as not applicable.

The staff concludes that the components addressed by this AMR item is not applicable

3.3.2.2.14 Loss of Material Due to Cladding Breach

LRA Section 3.3.2.2.14 addresses loss of material due to cladding breach in PWR steel charging pump casings with stainless steel cladding exposed to treated borated water. The applicant stated that this item is not applicable because these components are not applicable to BWR plants. The staff reviewed the UFSAR to verify the design of the auxiliary systems. In addition to the fact that the applicant operates a BWR, based on information in the UFSAR, the staff confirmed that the applicant's plant does not have stainless steel clad charging pumps exposed to treated borated water. Therefore, the staff finds that this item is not applicable.

The staff concludes that the components addressed by this AMR item do not exist and that this item is not applicable

3.3.2.2.15 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA program.

3.3.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.3.2-1 through 3.3.2-33, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

In LRA Tables 3.3.2-1 through 3.3.2-33, the applicant indicated, via notes F through J, that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 No Aging Effect on the Copper Alloy Components Exposed to Lubricating Oil

LRA Table 3.3.2-22 (page 3.3-188) addresses the copper alloy components of the reactor building closed-cycle cooling water system in the auxiliary systems. The applicant stated that the components are subject to no aging effect in a lubricating oil environment and the component type of the AMR item is "Heat exchanger, condenser, cooler, fan coil." The applicant also stated that the consistency note for the AMR item is note I, which means that aging effect in the GALL Report for this component, material, and environment is not applicable.

The staff evaluated the AMR item and related information in comparison with GALL Report items VII.C1-8 and VII.C2-5 for the copper alloy piping, piping components, and piping elements of the open-cycle cooling water system and closed-cycle cooling water system, respectively, in the auxiliary systems. The staff noted that the two AMR items in the GALL Report indicate that the copper alloy components exposed to lubricating oil are subject to loss of material due to pitting and crevice corrosion. In comparison with the aging effect in the GALL Report, the staff noted that using plant-specific note 232, the applicant stated that the component does not have the potential for water contamination. By letter dated November 13, 2009, the staff issued RAI 3.3.2.3-1 and RAI BF75-2 requesting that the applicant clarify why the components do not have the potential for water contamination and why the AMR item is not subject to loss of material. The staff also requested that, if applicable, the applicant provide the operating experience that supports the applicant's statement regarding no potential for water contamination in the lubricating oil.

In its response dated December 14, 2009, for RAI 3.3.2.3-1, and February 2, 2010, for RAI BF75-2, the applicant stated the AMR item involves the CRD pump lube oil coolers and the components are small tube and shell lube oil coolers with lube oil on the shell side and reactor building closed-cycle cooling water on the tube side. GALL Report Volume 2, item VII.C1-8 does not apply to this item since open-cycle cooling water is not involved. The applicant further stated that the heat exchanger shell material is copper alloy (brass/bronze) with Zn less than 15 percent. As discussed in the response to RAI 3.3.2.2.12-1 that referred to EPRI TR-1010639, Appendix C (regarding Lubricating Oil and Fuel Oil), Sections 3.1.3 and 3.1.4, crevice and pitting corrosion are applicable aging effects only if the copper alloy has Zn greater than 15 percent. Since the level of Zn in the copper alloy is less than 15 percent, GALL Report item VII.C2-5 does not apply. The review of LRA Table 3.3.2-22 indicated that plant-specific note 232 was listed in error. Accordingly, Notes 232, I for the LRA line item on page 3.3-188 is changed to Notes 225, I.

The staff noted that the applicant's justification for no aging effect of the components is based on the information that is described in EPRI TR-1010639, "Non-Class 1 Mechanical Guideline and Mechanical Tools," Revision 4, Appendix C – Lubricating Oil and Fuel Oil, Sections 3.1.3 and 3.1.4. The information for the pitting corrosion of copper alloys in a lubricating oil environment is summarized as follows: Oil and fuel oil are not good electrolytes, and water and aggressive species are necessary to propagate this corrosion mechanism. Therefore, pitting corrosion is an aging concern for carbon and low-alloy steel, cast iron, stainless steel, aluminum and aluminum alloys, and high Zn (greater than 15 percent) and aluminum bronze (greater than 8 percent Al) copper alloys under stagnant conditions where water contamination is present.

In its review, the staff finds that the response to RAI 3.3.2.3-1 clarifies that Notes 232, I is changed to 225, I and note 225 indicates that crevice and pitting corrosion are not applicable aging mechanisms for copper alloy components with less than 15 percent Zn. The staff finds that the applicant's review results in the RAI response are consistent with the description of "Copper alloy < 15% Zn" in the GALL Report Volume 2, Table IX.C, which states that copper, copper nickel, brass, bronze less than 15 percent Zn, and aluminum bronze less than 8 percent aluminum are resistant to pitting and crevice corrosion.

Based on its review, the staff finds the applicant's response to RAI 3.3.2.3-1 anf BF-75-2 acceptable because: (1) copper alloys with less than 15 percent Zn is resistant to pitting and crevice corrosion in accordance with the GALL Report, and (2) the applicant's change from note 232 to note 225 consistently clarifies that the copper alloys with Zn less than 15 percent are resistant to pitting and crevice corrosion in the lubricating oil environment. Therefore, the applicant's response to the RAI resolved the concern regarding the technical basis why the components are subject to no aging effects.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.2 Aluminum Alloy Filters, Screens, and Strainers Exposed to Dried Air

LRA Table 3.3.2-27 summarizes the results of AMR evaluations for the safety-related air system component groups. The applicant stated that there are no aging effects for aluminum alloy filters, screens, and strainers exposed to dried air. The applicant cited note F, indicating that the material is not addressed in the GALL Report for this component.

The staff evaluated that the applicant's use of note F is acceptable for this component type, material, and environment combination. The staff noted that aluminum has an excellent resistance to corrosion when exposed to air because the aluminum oxide film is bonded strongly to its surface and that, if damaged, reforms immediately in most environments providing a surface layer that is highly effective in protecting the aluminum from corrosion. The staff finds that aluminum exposed to a dried air environment does not have any applicable aging effect.

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).

3.3.2.3.3 Aluminum Alloy Pipe, Pipe Fittings, Hoses, Tubes, and Rupture Disks Exposed to Atmosphere/Weather (External)

LRA Table 3.3.2-29 summarizes the results of AMR evaluations for the standby diesel generator component groups. The applicant stated that there are no aging effects for aluminum alloy pipe, pipe fittings, hoses, tubes, and rupture disks exposed to atmosphere/weather (external). The applicant cited note G, which indicates that the environment is not addressed in the GALL Report for this component and material.

The staff evaluated that the applicant's use of note G is acceptable for this component type, material, and environment combination. The staff noted that aluminum has excellent resistance to corrosion when exposed to humid air (outdoor environment) because the aluminum oxide film is bonded strongly to its surface and that, if damaged, reforms immediately in most environments, thus providing a protective layer which is effective in protecting the aluminum from corrosion. The staff finds that aluminum exposed to an outdoor air environment does not have any applicable aging effect.

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).

3.3.2.3.4 Zinc exposed to an air-indoor uncontrolled or dried air environment

LRA Table 3.3.2-27 addresses aging management evaluations for components within the auxiliary systems relating to the safety-related air system. The applicant stated that for filters, screens, strainers, valves, and dampers made of Zn exposed to an air-indoor uncontrolled or dried air environment, no AERMs were found. Therefore, no AMP was assigned for these component/material/environment combinations. The staff noted that the GALL Report recommends no AERMs for galvanized steel piping, piping components, and piping elements in an air-indoor uncontrolled environment, as indicated in GALL Report item VII.J-6, and for steel piping, piping components, and piping elements in dried air, as indicated in GALL Report item VII.J-22.

The staff evaluated the applicant's AMR and by letter dated January 6, 2010, the staff issued RAI BF76-6 requesting that the applicant provide justification as to the applicability of aging management of the galvanized steel and steel components in GALL Report items VII.J-6 and VII.J-22 to the material/environment combinations identified previously.

In its response dated February 2, 2010, the applicant stated that the LRA Table 3.3.2-27 line items for "Filter, screens, strainer" of material Zn, on page 3.3-218, represent a filter housing for the safety-related air system that has an external environment of air-indoor uncontrolled and an internal environment of dried air. The applicant further stated that the line items for "valve, damper" of material Zn, on page 3.3-221, represent a pressure control valve in the safety-related air system that also has an external environment of air-indoor uncontrolled and an internal environment of dried air. The applicant also stated that no listing was identified in the GALL Report for the material Zn; therefore, note F was applied to these line items and the GALL Report does have a listing for galvanized steel in air-indoor uncontrolled (GALL Report item VII.J-6) and steel in dried air (GALL Report item VII.J-22). The applicant further stated that these items indicate there are no AERMs and no AMP is required and that galvanized steel and steel materials would be conservative references for the Zn components in similar environments. Therefore, the LRA Table 3.3.2-27 line items for these Zn components that identify no AERMs and require no AMP are validated by these GALL Report line items. Based on its review, the staff finds the applicant's response to RAI BF76-6 acceptable because for uncontrolled indoor air, the GALL Report indicates that galvanized steel is not subject to any aging effects and does not require aging management. Since water is generally necessary for galvanized steel to corrode at ambient temperatures, if galvanized steel does not undergo aging in uncontrolled indoor air, it should not undergo aging in dry air either.

Based on the absence of aging in indoor and dried air for galvanized steel, the staff considers that Zn components are also not subject to aging under these conditions. The staff's concern in RAI BF76-6 is resolved.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.5 Stainless Steel Fasteners, Bolting, Washers, and Nuts Exposed to Air-Indoor Uncontrolled (External)

LRA Tables 3.3.2-3 through 3.3.2-7, 3.3.2-10, 3.3.2-12, 3.3.2-14, 3.3.2-17, 3.3.2-19 through 3.3.2-21, 3.3.2-23 through 3.3.2-25, and 3.3.2-27 through 3.3.2-33 state that stainless steel fasteners, bolting, washers, and nuts exposed to air-indoor uncontrolled (external) have an aging effect of loss of preload and that the aging effect is managed by the Bolting Integrity Program. The AMR line items cite generic note F, indicating that the material is not in the GALL Report for this component.

The staff evaluated the applicant's use of note F for this component, material, and environment combination by confirming that in the GALL Report, there are no AMR results shown for bolting material made of stainless steel exposed to air-indoor uncontrolled (external). This review confirmed that the applicant's use of generic note F is acceptable.

The staff noted that the mechanisms identified to cause loss of preload in carbon steel or low alloy bolting material (thermal effects, gasket creep, and self-loosening) can also cause loss of preload in stainless steel bolting. The staff also noted that activities in the Bolting Integrity Program that manage the aging effect of loss of preload are equally effective for carbon steel and stainless steel bolts. The staff further noted that the GALL Report (item VII.I-5 (AP-26)) recommends using the Bolting Integrity Program to manage the aging effect of loss of preload in carbon steel bolts exposed to air-indoor uncontrolled. On the basis that the Bolting Integrity Program's activities for managing loss of preload are applicable for both carbon steel and stainless steel bolts and the GALL Report recommends the Bolting Integrity Program for managing loss of preload in carbon steel bolting, the staff finds the applicant's use of the Bolting Integrity Program to manage loss of preload in stainless steel bolts exposed to air-indoor uncontrolled 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, as required by 10 CFR 54.21(a)(3).

3.3.2.3.6 Steel or Stainless Steel Fasteners, Bolting, Washers, and Nuts Exposed to Raw Water (External)

LRA Tables 3.3.2-10, 3.3.2-11, 3.3.2-16, 3.3.2-25, and 3.3.2-26 state that steel or stainless steel fasteners, bolting, washers, and nuts exposed to raw water (external) have an aging effect of loss of preload and that the aging effect is managed by the Bolting Integrity Program. For the stainless steel components, the AMR line items cite note F, indicating that the material is not in the GALL Report for this component. For the steel components, the AMR line items cite note G, indicating that the environment is not in the GALL Report for this component and material combination.

The staff evaluated the applicant's use of note F for stainless steel bolting in raw water by reviewing the GALL Report, Volume 2, Chapter VII, Section I, "External Surfaces of Components and Miscellaneous Bolting for Auxiliary Systems," and noting that there are no AMR results shown for bolting material made of stainless steel. Based on its review, the staff confirmed that the applicant's use of note F is acceptable. The staff evaluated the applicant's use of note G for steel bolting in raw water by reviewing all steel bolting entries in the GALL

Report, Volume 2, Chapter VII, Section I, and noting that there are no steel bolting components shown in a raw water environment. Based on its review, the staff confirmed that the applicant's use of note G is acceptable.

The staff's evaluation of the applicant's Bolting Integrity Program is documented in SER Section 3.0.3.1.6. Based on its review of the applicant's AMP, the staff was unable to determine how the Bolting Integrity Program would be used to manage the aging effect of loss of preload in steel or stainless steel bolts exposed to a raw water environment. In a letter dated November 13, 2009, the staff issued RAI Table 3.3.2-25-01 asking the applicant to explain how the Bolting Integrity Program manages loss of preload for steel or stainless steel bolts exposed to a raw water environment.

In its response dated December 14, 2009, the applicant stated that in LRA Tables 3.3.2-10, 3.3.2-11, 3.3.2-25, and 3.3.2-26, the subject bolting is pump column pressure boundary closure bolting and in LRA Table 3.3.2-16, the subject bolting is intake traveling screens structural support bolting. The applicant stated that the pump column pressure boundary closure bolting is assembled using the Bolting Integrity Program requirements for proper design, proper torque, and approved maintenance practices prior to being installed and submerged. The applicant further stated that during plant operations, plant operators monitor pump performance using installed instrumentation (pressure and flow indication) and that vibration monitoring equipment is also installed on rotating equipment. The applicant stated that if operating parameters should change to indicate degradation of pump performance, the condition would be entered into the Corrective Action Program to initiate corrective actions. The applicant further stated that when pump pits are drained or pump maintenance is performed, fasteners can be inspected for any evidence of loss of preload. The applicant also stated that the intake traveling screen stainless steel fasteners in raw water are inspected under the Bolting Integrity Program during the External Surfaces Monitoring Program walkdowns. The applicant revised LRA Table 3.3.2-26 on page 3.3-161 to change the intended function from “pressure boundary” to “structural support” for the stainless steel fasteners, bolting, washers, and nuts in the intake and traveling screens system.

The staff reviewed the applicant's response and noted that the response credits features and elements that were included in the staff's evaluation of the applicant's Bolting Integrity Program and determined to be capable of preventing or mitigating loss of preload in bolting and fasteners. The staff further noted that the applicant identified operational performance monitoring as potentially useful in identifying problems that might result from reduction or loss of bolting and fastener preload.

Based on its review, the staff finds the applicant's response to RAI Table 3.3.2-25-01 acceptable because the applicant provided a satisfactory explanation of how the Bolting Integrity Program prevents or mitigates loss of preload in steel and stainless steel bolting and fasteners exposed to a raw water environment, as described above. The staff also finds the applicant's changes to LRA Table 3.2.2-26 to be acceptable because the change corrects the identification of the intended function for stainless steel bolting exposed to raw water in the intake and traveling screens system. The staff's concern described in RAI Table 3.3.2-25-01 is resolved.

On the basis of its review, including the applicant's response to RAI Table 3.3.2-25-01, 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).

3.3.2.3.7 PVC/Plastic Pipe, Pipe Fittings, Hoses, Tubes, or Rupture Disks Exposed to Air-Indoor Uncontrolled (External) and to Treated Water (Internal) or to Raw Water (Internal)

LRA Tables 3.3.2-2, 3.3.2-3, 3.3.2-9, 3.3.2-13, 3.3.2-21, and 3.3.2-32 state that pipe, pipe fittings, hoses, tubes, or rupture disks made of PVC/plastic exposed to air-indoor uncontrolled (external) and to treated water (internal) does not have an AERM and that no AMP is needed. LRA Table 3.3.2-4 states that pipe, pipe fittings, hoses, tubes, or rupture disks made of PVC/plastic exposed to air-indoor uncontrolled (external) and to raw water (internal) also does not have an AERM and that no AMP is needed. LRA Table 3.3.2-16 states that pipe, pipe fittings, hoses, tubes, or rupture disks made of PVC/plastic exposed to raw water (internal and external) does not have an AERM and that no AMP is needed. The AMR line items cite note J, indicating that the component, material, and environment combinations are not evaluated in the GALL Report.

The staff evaluated the applicant's AMR and by letter dated January 6, 2010, the staff issued RAI BF76-5 requesting that the applicant explain why PVC/plastics is not subject to degradation resulting from various aging mechanisms identified in the GALL Report in a raw water or air-indoor uncontrolled environment. In its response dated February 2, 2010, the applicant stated that the aging effects for mechanical systems that use PVC piping having a raw water or treated water internal environment and an air-indoor uncontrolled exterior environment were determined by consulting the information provided in EPRI 1010639, "Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools," Revision 4. The applicant also stated that the PVC aging effects listed in GALL Report items VI.A-6 and VI.A-14 for electrical fuse holders or metal-enclosed bus insulators were not used, since these aging effects were targeted toward the loss of insulating capability and do not correlate directly to pressure boundary or leakage boundary (spatial) effects that are applicable to the mechanical PVC piping components. The applicant further stated that EPRI 1010639 discusses the potential for loss of material, change in properties, or cracking of thermoplastic PVC if the material or design application is selected improperly and that the thermoplastic PVC used for applications in nuclear power plant raw water and treated water systems is not expected to degrade based on industry operating experience with PVC materials that were properly selected and applied. The applicant also stated that, according to EPRI 1010639, the factors related to improper selection or design application that may contribute to the degradation of thermoplastics, such as PVC, are exposure to UV radiation, chemical degradation, elevated temperatures, and solvents which cause oxidation reactions. The applicant stated that it evaluated the material application for cracking, changes in material properties, and loss of material due to accumulated ionizing radiation, ozone, UV, and thermal exposure; and loss of material due to aggressive chemical attack. The applicant finally stated that the evaluations concluded that: (1) none of the raw water or treated water internal environments contained chemicals that were incompatible with the design application of the installed thermoplastic PVC piping; (2) none of the external surfaces of the PVC piping is subject to the UV exposure of direct sunlight or ionizing radiation exceeding 10E6 rads total integrated dose over the period of extended operation, nor are they exposed to high levels of ozone that might be associated with high-voltage electrical equipment; and (3) none of the internal raw or treated water environments was found to exceed 95 °F that could lead to thermal degradation.

Based on its review, the staff finds the applicant's response to RAI BF76-5 acceptable because it demonstrated that none of the environmental factors exist that could cause aging in the

PVC/plastics components exposed to a raw water or air-indoor uncontrolled environment. The staff's concern described in RAI BF76-5 is resolved.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.8 Carbon Steel Fasteners, Bolting, Washers, and Nuts Exposed to Soil (External)

LRA Table 3.3.2-11 states that carbon steel fasteners, bolting, washers, and nuts exposed to soil (external) are being managed for the loss of preload aging effect by the Bolting Integrity Program. The AMR line item cites generic note G, indicating that for the line item the environment is not in the GALL Report for this component and material.

The staff reviewed all AMR result line items in the GALL Report where the material is carbon steel and the aging effect/mechanism is loss of preload and confirmed that for this environment, there are no entries in the GALL Report for this component and material.

The staff reviewed the applicant's Bolting Integrity Program and its evaluation is documented in SER Section 3.0.3.1.6. 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 the GALL Report [item VIII.H-5 (S-33)] recommends using the Bolting Integrity Program to manage the aging effect of loss of preload in carbon steel bolts exposed to air – indoor uncontrolled. The staff further noted that since the Bolting Integrity Program's activities for managing loss of preload are applicable for other bolting materials and environments, the soil (external) environment is an applicable environment for the management of the loss of preload aging effect. Furthermore, the staff noted that as a part of the Bolting Integrity Program review, the staff had issued RAI B.3.6-02 requesting clarification for how bolting related inspections would be carried out for fasteners, bolting, washers, and nuts exposed to a soil environment, which is evaluated and documented in SER Section 3.0.3.1.6. Included in the response is Commitment No. 41, which states that the applicant will specifically address the inspection of fasteners (bolting, washers, nuts, etc.) for signs of leakage, corrosion/loss of material, cracking, and loss of preload/loss of prestress, as applicable. The staff notes that the Bolting Integrity Program will inspect for aging related to components in a soil (external) environment including verifying that the aging effect, loss of preload, will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, and is therefore acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.9 Brass Valves and Dampers Exposed to Steam

In LRA Table 3.3.2-6 the applicant stated that brass valves and dampers exposed to steam are being managed for loss of material by the Inspection of Internal Surfaces in Miscellaneous

Piping and Ducting Components Program. The applicant cited generic note H, indicating that the aging effect is not in the GALL Report for this component, material, and environment combination.

The staff reviewed all AMR result lines in the GALL Report where the material is brass and the aging effect is loss of material. The staff notes that brass is included in the GALL Report as a copper alloy and that there are no results in the GALL report for copper alloy components exposed to steam.

The staff's reviewed the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.20. The staff notes that this program requires inspections performed during the pre-planned periodic system and component maintenance activities when the systems are opened and the surfaces are made accessible for visual inspection. The staff also notes that the visual inspection techniques established in the program are capable of detecting loss of material due to corrosion by the presence of localized discoloration and surface irregularities such as, scale, deposits, surface pitting, and surface discontinuities. The staff notes, based on a review of NACE International materials, that the principal corrosion problems with brass are dezincification and stress corrosion cracking, neither of which are accelerated by a steam environment. The staff finds the applicant's currently proposed aging management program acceptable because it uses visual inspection techniques capable of detecting loss of material for brass componentsand the environement is not expected to cause accelerated corrosion.

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).

3.3.2.3.10 Electrical Resistance Heater and Heat Trace exposed to Air Uncontrolled Indoor

In LRA Tables 3.3.2-6, 3.3.2-7, 3.3.2-33 the applicant stated that for carbon steel electrical resistance heater, heat trace, flow elements, class 1 pipe, pipe fittings, tubing, class 1 valve, pressure vessels, valves and dampers exposed to air indoor uncontrolled, where LRA footnote 231 is applicable (i.e., loss of material due to corrosion is not an applicable aging effect due to system temperatures are greater than 212^{o} F), there is no aging effect and no AMP is proposed. The AMR line items cite generic note I, indicating that the aging effect in the GALL Report for this line item's component, material and environment combination is not applicable.

The staff reviewed all AMR result line items in the GALL Report where the component and material is carbon steel electrical resistance heater, heat trace, flow elements, class 1 pipe, pipe fittings, tubing, class 1 valve, pressure vessels, valves and dampers and confirmed that the component, material and environment combination is not applicable.

The staff finds the applicant's proposal acceptable because given that the temperature in the piping systems are above 212^{o} F, the uncontrolled indoor air will have the same environmental impact as dried air. The GALL Report, VII.J-22, states that dried air has no aging effect on steel and no AMP is recommended. The staff notes that there will be periods of time during unit shutdowns where the systems will not be at or above 212^{o} F. Nevertheless, these periods are short and any accumulated moisture on the external surfaces of the steel is rapidly dried as the systems are started, resulting in minimal aging effects.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM and AMP combinations not addressed in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.11 Copper Heat Exchanger, Condenser, Cooler, and Fan Coils Exposed to Treated Water

In LRA Table 3.3.2-6 the applicant stated that copper heat exchanger, condenser, cooler, and fan coils exposed to treated water are being managed for loss of material by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The applicant cited generic note G, indicating that the environment is not in the GALL Report for this component and material.

The staff reviewed all AMR result lines in the GALL Report where the material is copper and the aging effect is loss of material. The staff noted that copper is included in the GALL Report definition of copper alloy and that the recommended program for copper alloy components exposed to treated water is the “Water Chemistry Program,” augmented by the “One-Time Inspection Program” to verify the effectiveness of the “Water Chemistry Program.” It was not clear to the staff why the applicant chose to use the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage aging for these copper alloy components exposed to treated water. By letter dated November 13, 2009, the staff issued RAI Copper Alloy requesting that the applicant provide justification for using the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program as opposed to the “Water Chemistry Program” augmented by the “One-Time Inspection Program” as recommended by the GALL Report.

In its response dated December 14, 2009, the applicant stated that the components exposed to treated water being managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program are exposed to demineralized water. The applicant also stated that its Water Chemistry Program is used to control water chemistry for those water systems directly connected to the reactor, in accordance with EPRI guidelines, and it is not an appropriate program to manage the water chemistry of the demineralized water system. The applicant further stated that it’s Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will visually inspect these copper alloy components to ensure that existing environmental conditions are not causing metal degradation. The staff reviewed the applicant’s Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.1.3.20. The staff finds the applicant’s management of the effect of aging acceptable because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program requires inspections at appropriate frequencies and locations, and the inspections will detect loss of material prior to loss of the component’s intended function during the period of extended operation.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.12 Aluminum Valve Dampers Exposed to Dried Air - Internal

In LRA Table 3.3.2-5, the applicant stated that for aluminum valve dampers exposed to dried air - internal, there is no aging effect or proposed aging management program. The AMR line item cites generic note G, indicating that for the line item the environment is not in the GALL Report for this component and material.

The staff reviewed all AMR result line items in the GALL Report where material is aluminum and confirmed that for this environment, there are no entries in the GALL Report for this component and material. The staff notes that the GALL Report, VII.J-1, states that for aluminum components exposed to air-indoor uncontrolled there is no aging effect or recommended AMP.

The staff finds the applicant's proposal acceptable because aluminum has an excellent resistance to corrosion when exposed to air because the aluminum oxide film is bonded strongly to its surface and that, if damaged, reforms immediately in most environments providing a surface layer that is highly effective in protecting the aluminum from corrosion. The staff finds that aluminum exposed to a dried air environment does not have any applicable aging effect.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM and AMP combinations not addressed in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.13 Carbon Steel Pipe, Pipe Fittings, Hoses, Tubes, Rupture Disks, and Valves and Copper, Copper-Nickel Heat Exchanger Components Exposed to Raw Water (Internal)

In LRA Tables 3.3.2-4, 3.3.2-11, 3.3.2-13, 3.3.2-18, 3.3.2-20, 3.3.2-23, and 3.3.2-25, the applicant stated the carbon steel piping, pipe fittings, hoses, tubes, rupture disks, valves and copper, copper-nickel heat exchanger components exposed to raw water are being managed for loss of material by the Flow-Accelerated Corrosion Program. The AMR line items cite generic note H, indicating that for the line items, the aging effect is not in the GALL Report for this component, material, and environment combination. The applicant also cited plant-specific note 222 for each of the associated line items, which stated that erosion had occurred on some components, as described in the plant operating experience database, and that the loss of material due to erosion for these components is managed by the Flow-Accelerated Corrosion Program.

The staff reviewed all AMR result line items in the GALL Report where the component and material is carbon steel piping, pipe fittings, hoses, tubes, rupture disks, valves and copper, copper-nickel heat exchanger components exposed to raw water and confirmed that there are no aging effect entries in the GALL Report for this component, material, and environment combination.

The staff reviewed the applicant's Flow-Accelerated Corrosion Program and its evaluation is documented in SER Section 3.0.3.1.17. The staff finds the applicant's currently proposed AMP acceptable because, as clarified in its follow-up response to RAI B3.24-1 dated February 2, 2010, the applicant provided details on their Flow-Accelerated Corrosion Program including stating that the program includes inspection of locations susceptible to erosion based on operating experience, uses the same techniques as those used for measuring wall thinning due to flow-accelerated corrosion, trends inspection results, and initiates corrective actions prior to loss of intended function. This AMP is capable of detecting and managing the loss of material due to erosion in carbon steel pipe and components and copper, copper-nickel heat exchanger components exposed to raw water.

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).

3.3.2.3.14 Damper Exposed to Air - Indoor Uncontrolled (External) and Raw Water (Internal)

In LRA Table(s) 3.3.2-3 and 3.3.2-4, the applicant stated that valves and dampers made of polyvinyl chloride (PVC) exposed to air – indoor uncontrolled on the exterior and treated or raw water on the interior, there is no aging effect and no AMP is proposed. The AMR line items cite generic note J, indicating that for this line item, neither the component nor the material and environment combination are evaluated in the GALL Report.

The staff reviewed all AMR result line items in the GALL Report where the component and material is valves and dampers made of PVC exposed to air – indoor uncontrolled on the exterior and treated or raw water on the interior and confirmed that there are no entries for this component/material and environment.

The staff notes that multiple industry references (e.g., Standard handbook of Plant Engineering, Facility Piping Systems Handbook, Piping Handbook of Plant Engineering) stat that PVC material is vulnerable to UV radiation, chemical degradation, elevated temperature, and petroleum-based solvents, which lead to oxidation reaction. The staff also notes that none of the aforementioned factors which cause aging to PVC material is expected to be present for these components because (1) the valve/damper component is in an in-door environment away from sunlight and other UV/ozone sources, (2) the raw water temperature is expected to be near ambient, and (3) solvents and other aggressive chemicals are not expected to come into constant contact with the component. The staff finds the applicant's aging management review to be acceptable because given the materials and environment, there are no aging effects requiring management.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM and AMP combinations not addressed in the GALL Report. The staff finds the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended period of operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3.15 Admiralty Brass and Copper Alloys with Greater than 15% Zinc Heat Exchangers and Heat Exchanger Components and Elements Exposed to Lubricating Oil (external)

In LRA Table 3.3.2-29 the applicant stated that the admiralty brass and copper alloys with greater than 15% zinc heat exchangers and heat exchanger components and elements exposed to lubricating oil (external) are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program. The AMR line items cite generic note H, indicating that for the line items, the aging effect is not in the GALL Report for these components, materials, and environment combination. The applicant also cited plant specific note 207 for each of the associated line items, which stated that, "Material/environment combination and/or aging effect/mechanism not identified in NUREG-1801. The aging management program(s) referenced are appropriate for the aging effects/mechanisms identified and provide assurance that the aging effects/mechanisms are effectively managed through the period of extended operation."

The staff reviewed all AMR result line items in the GALL Report where the components and materials are admiralty brass and copper alloys with greater than 15% zinc heat exchangers and heat exchanger components and elements exposed to lubricating oil (external) and confirmed that there are no aging effect entries in the GALL Report for these components, materials, and environment combination.

The staff reviewed the applicant's Selective Leaching of Materials Program and its evaluation is documented in SER Section 3.0.3.1.24. The staff notes that the GALL Report recommends the "Selective Leaching of Materials Program" to manage the effects of loss of material due to selective leaching for copper alloy components with greater than 15% zinc exposed to raw and treated water and that lubricating oil is less corrosive than raw water. The staff also notes that admiralty brass is an alloy of copper, zinc and tin that is generally less susceptible to selective leaching than other copper alloys with greater than 15% zinc. The staff finds the applicant's currently proposed AMP acceptable because the Selective Leaching of Materials Program performs inspections and hardness measurements or mechanical tests which are capable of detecting loss of material due to selective leaching.

In LRA Table 3.3.2-11 the applicant stated that admiralty brass heat exchangers and heat exchanger components and elements exposed to lubricating oil (external) are being managed for loss of material due to selective leaching by the Selective Leaching of Materials Program. The AMR line items cite the generic note J, indicating that for these line items, neither the component nor the material and environment combination is evaluated in the GALL Report. The applicant also cited plant specific note 207 for each of the associated line items, which stated that, "Material/environment combination and/or aging effect/mechanism not identified in NUREG-1801. The aging management program(s) referenced are appropriate for the aging effects/mechanisms identified and provide assurance that the aging effects/mechanisms are effectively managed through the period of extended operation."

The staff reviewed all AMR result line items in the GALL Report where the component and material is admiralty brass and heat exchangers and heat exchanger elements and confirmed that there are no entries for this component and material where the aging effect and mechanism is loss of material due to selective leaching.

The staff reviewed the applicant's Selective Leaching of Materials Program and its evaluation is documented in SER Section 3.0.3.1.24. The staff notes that the GALL Report recommends the "Selective Leaching of Materials Program" to manage the effects of loss of material due to selective leaching for copper alloy components with greater than 15% zinc exposed to raw and treated water and that lubricating oil is less corrosive than raw water. The staff also notes that admiralty brass is an alloy of copper, zinc and tin that is generally less susceptible to selective leaching than other copper alloys with greater than 15% zinc. The staff finds the applicant's currently proposed AMP acceptable because the Selective Leaching of Materials Program performs inspections and hardness measurements or mechanical tests which are capable of detecting loss of material due to selective leaching.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.3 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, as required by 10 CFR 54.21(a)(3).

3.4 Aging Management of Steam and Power Conversion Systems

This section of the SER documents the staff's review of the applicant's AMR results for the steam and power conversion systems components and component groups of:

- condensate and demineralized water system
- condensate and feedwater system
- condenser and condenser air removal system
- main steam isolation and automatic depressurization system
- turbine

3.4.1 Summary of Technical Information in the Application

LRA Section 3.4 provides AMR results for the steam and power conversion systems components and component groups. LRA Table 3.4.1, "Summary of Aging Management Evaluations in Chapter VIII of NUREG-1801 Steam and Power Conversion Systems," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the steam and power conversion systems components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry 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 operating experience issues identified since the issuance of the GALL Report.

3.4.2 Staff Evaluation

The staff reviewed LRA Section 3.4 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the steam and power conversion systems components within the scope of license renewal and subject to an AMR, will be

adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted an onsite audit of AMRs to ensure the applicant's claim that certain AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluations of the AMPs are documented in SER Section 3.0.3. Details of the staff's audit evaluation are documented in SER Section 3.4.2.1.

In the onsite audit, the staff also selected AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the SRP-LR Section 3.4.2.2 acceptance criteria. The staff's audit evaluations are documented in SER Section 3.4.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with or not addressed in the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed were appropriate for the material-environment combinations specified. The staff's evaluations are documented in SER Section 3.4.2.3.

For SSCs which the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR line items and the plant's operating experience to verify the applicant's claims.

The staff's review of the steam and power conversion systems component groups followed any one of several approaches. One approach, documented in SER Section 3.4.2.1, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.4.2.2, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.4.2.3, reviewed AMR results for components that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the steam and power conversion systems components is documented in SER Section 3.0.3.

3.4.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.4.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the steam and power conversion systems components:

- Aboveground Steel Tanks Program
- ASME Code Class 1 Small-Bore Piping Inspection Program
- ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD Program
- Bolting Integrity Program
- Buried Piping and Tanks Inspection Program
- External Surfaces Monitoring Program
- Flow-Accelerated Corrosion Program

- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Lubricating Oil Analysis Program
- One-Time Inspection Program
- Open Cycle Cooling Water System Program
- Selective Leaching of Materials Program
- Water Chemistry Program

LRA Tables 3.4.2-1 through 3.4.2-5 summarize AMRs for the steam and power conversion systems components and indicate AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency with the report and for which it does not recommend further evaluation, the staff's audit and review determined whether the plant-specific components of these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant noted for each AMR line item how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A through E indicating how the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report and validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report and verified that the identified exceptions to the GALL Report AMPs have been reviewed and accepted. The staff also determined whether the applicant's AMP was consistent with the GALL Report AMP and whether the AMR was valid for the site-specific conditions.

Note C indicates that the component for the AMR line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report; however, the applicant identified in the GALL Report a different component with the same material, environment, aging effect, and AMP as the component under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicates that the component for the AMR line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component was applicable to the component under review and whether the identified exceptions to the GALL Report AMPs have been reviewed and accepted. The staff also determined whether the applicant's AMP was consistent with the GALL Report AMP and whether the AMR was valid for the site-specific conditions.

Note E indicates that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but credits a different AMP. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the credited AMP would manage the aging effect consistently with the GALL Report AMP and whether the AMR was valid for the site-specific conditions.

The staff audited and reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluation follows.

3.4.2.1.1 AMR Results Identified as Not Applicable

LRA Table 3.4-1, line item 3.4.1-21 addresses high-strength steel closure bolting exposed to air with steam or water leakage. The GALL Report recommends the use of GALL AMP XI.M18, "Bolting Integrity," to manage cracking due to cyclic loading and SCC for this component group. The applicant stated that this line item is not applicable because the steam and power conversion systems have no high-strength steel closure bolting exposed to air with steam or water leakage at DAEC. The staff reviewed LRA Sections 2.3.4 and 3.4 and confirmed that the applicant's LRA does not have any AMR results for the steam and power conversion systems that include high-strength steel closure bolting exposed to air with steam or water leakage. The staff also noted that a search of the Audit Report did not find any evidence of high-strength steel closure bolting exposed to air with steam or water leakage in the steam and power conversion systems. The staff also noted that a search of the applicant's UFSAR and technical specifications, did not find any evidence of high-strength steel closure bolting in the steam and power conversion systems exposed to air with steam or water leakage. Based on its review of the LRA, UFSAR, technical specifications, and Audit Report, the staff confirmed that there are no in-scope high-strength steel closure bolting exposed to air with steam or water leakage in the steam and power conversion systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.4-1, line item 3.4.1-23 addresses stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water greater than 60 °C (140 °F). The GALL Report recommends the use of GALL AMP XI.M21, "Closed-Cycle Cooling Water System," to manage cracking due to SCC and loss of material due to pitting and crevice corrosion for this component group. The applicant stated that this line item is not applicable because the applicant's steam and power conversion systems do not contain stainless steel components exposed to closed-cycle cooling water greater than 60 °C (140 °F). The staff reviewed LRA Sections 2.3 and 3.4 and confirmed that the applicant's LRA does not have any AMR results for the steam and power conversion systems that include stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water greater than 60 °C (140 °F). The staff also noted that a search of the applicant's UFSAR did not find any evidence of stainless steel piping, piping components, and piping elements in the steam and power conversion systems exposed to closed-cycle cooling water greater than 60 °C (140 °F). Based on its review of the LRA and UFSAR, the staff confirmed that there are no in-scope stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water greater than 60 °C (140 °F) in the steam and power conversion systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.4-1, line item 3.4.1-24 addresses steel heat exchanger components exposed to closed-cycle cooling water. The GALL Report recommends the use of GALL AMP XI.M21, “Closed-Cycle Cooling Water System,” to manage the loss of material due to general, pitting, crevice, and galvanic corrosion for this component group. The applicant stated that this line item is not applicable because the applicant’s steam and power conversion systems do not contain steel heat exchanger components exposed to closed-cycle cooling water. The staff reviewed LRA Sections 2.3 and 3.4 and confirmed that the applicant’s LRA does not have any AMR results for the steam and power conversion systems that include steel heat exchanger components exposed to closed-cycle cooling water. The staff also noted that a search of the applicant’s UFSAR did not find any evidence of steel heat exchanger components in the steam and power conversion systems exposed to closed-cycle cooling water. Based on its review of the LRA and UFSAR, the staff confirmed that there are no in-scope steel heat exchanger components exposed to closed-cycle cooling water in the steam and power conversion systems and, therefore, finds the applicant’s determination acceptable.

LRA Table 3.4-1, line item 3.4.1-25 addresses stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water. The GALL Report recommends the use of GALL AMP XI.M21, “Closed-Cycle Cooling Water System” to manage the loss of material due to pitting and crevice corrosion for this component group. The applicant stated that this line item is not applicable because the applicant’s steam and power conversion systems do not contain stainless steel components exposed to closed-cycle cooling water. The staff reviewed LRA Sections 2.3 and 3.4 and confirmed that the applicant’s LRA does not have any AMR results for the steam and power conversion systems that include stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water. The staff also noted that a search of the applicant’s UFSAR did not find any evidence of stainless steel piping, piping components, piping elements, and heat exchanger components in the steam and power conversion systems exposed to closed-cycle cooling water. Based on its review of the LRA and UFSAR, the staff confirmed that there are no in-scope stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water in the steam and power conversion systems and, therefore, finds the applicant’s determination acceptable.

LRA Table 3.4-1, line item 3.4.1-26 addresses copper alloy piping, piping components, and piping elements exposed to closed-cycle cooling water. The GALL Report recommends the use of GALL AMP XI.M21, “Closed-Cycle Cooling Water System,” to manage the loss of material due to pitting, crevice, and galvanic corrosion for this component group. The applicant stated that this line item is not applicable because the applicant’s steam and power conversion systems do not contain copper alloy components exposed to closed-cycle cooling water. The staff reviewed LRA Sections 2.3 and 3.4 and confirmed that the applicant’s LRA does not have any AMR results for the steam and power conversion systems that include copper alloy piping, piping components, and piping elements exposed to closed-cycle cooling water. The staff also noted that a search of the applicant’s UFSAR did not find any evidence of copper alloy piping, piping components, and piping elements in the steam and power conversion systems exposed to closed-cycle cooling water. Based on its review of the LRA and UFSAR, the staff confirmed that there are no in-scope copper alloy piping, piping components, and piping elements exposed to closed-cycle cooling water in the steam and power conversion systems and, therefore, finds the applicant’s determination acceptable.

LRA Table 3.4-1, line item 3.4.1-27 addresses steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed-cycle cooling water. The GALL Report recommends the use of GALL AMP XI.M21, “Closed-Cycle Cooling Water System,” to manage the reduction in heat transfer due to fouling for this component group. The applicant stated that this line item is not applicable because the applicant’s steam and power conversion systems do not contain steel, stainless steel, and copper alloy components exposed to closed-cycle cooling water. The staff reviewed LRA Sections 2.3 and 3.4 and confirmed that the applicant's LRA does not have any AMR results for the steam and power conversion systems that include steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed-cycle cooling water. The staff also noted that a search of the applicant's UFSAR did not find any evidence of steel, stainless steel, and copper alloy heat exchanger tubes in the steam and power conversion systems exposed to closed-cycle cooling water. Based on its review of the LRA and UFSAR, the staff confirmed that there are no in-scope steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed-cycle cooling water in the steam and power conversion systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.4-1, line item 3.4.1-30 addresses steel piping, piping components, and piping elements exposed to air outdoor (internal) or condensation (internal). The GALL Report recommends the use of GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," to manage the loss of material due to general, pitting, and crevice corrosion for this component group. The applicant stated that this line item is not applicable because the applicant's steam and power conversion systems do not contain steel piping components exposed to outdoor air or condensation. The staff reviewed LRA Sections 2.3 and 3.4 and confirmed that the applicant's LRA does not have any AMR results for the steam and power conversion systems that include steel piping, piping components, and piping elements exposed to outdoor air or condensation. The staff also noted that a search of the applicant's UFSAR did not find any evidence of steel piping, piping components, and piping elements in the steam and power conversion systems exposed to outdoor air or condensation. Based on its review of the LRA and UFSAR, the staff confirmed that there are no in-scope steel piping, piping components, and piping elements exposed to outdoor air or condensation in the steam and power conversion systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.4-1, line item 3.4.1-32 addresses stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water. The GALL Report recommends the use of GALL AMP XI.M20, "Open-Cycle Cooling Water System," to manage the loss of material due to pitting, crevice, and microbiologically-influenced corrosion for this component group. The applicant stated that this line item is not applicable because the applicant's steam and power conversion systems do not contain stainless steel or copper alloy components exposed to raw water. The staff reviewed LRA Sections 2.3 and 3.4 and confirmed that the applicant's LRA does not have any AMR results for the steam and power conversion systems that include stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water. The staff also noted that a search of the applicant's UFSAR did not find any evidence of stainless steel and copper alloy piping, piping components, and piping elements in the steam and power conversion systems exposed to raw water. Based on its review of the LRA and UFSAR, the staff confirmed that there are no in-scope stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water in the steam and power conversion systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.4-1, line item 3.4.1-33 addresses stainless steel heat exchanger components exposed to raw water. The GALL Report recommends the use of GALL AMP XI.M20, "Open-Cycle Cooling Water System," to manage the loss of material due to pitting, crevice, and microbiologically-influenced corrosion and fouling for this component group. The applicant stated that this line item is not applicable because the applicant's steam and power conversion systems do not contain stainless steel heat exchanger components exposed to raw water. The staff reviewed LRA Sections 2.3 and 3.4 and confirmed that the applicant's LRA does not have any AMR results for the steam and power conversion systems that include stainless steel heat exchanger components exposed to raw water. The staff also noted that a search of the applicant's UFSAR did not find any evidence of stainless steel heat exchanger components in the steam and power conversion systems exposed to raw water. Based on its review of the LRA and UFSAR, the staff confirmed that there are no in-scope stainless steel heat exchanger components exposed to raw water in the steam and power conversion systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.4-1, line item 3.4.1-34 addresses steel, stainless steel, and copper alloy heat exchanger tubes exposed to raw water. The GALL Report recommends the use of GALL AMP XI.M20, "Open-Cycle Cooling Water System," to manage the reduction of heat transfer due to fouling for this component group. The applicant stated that this line item is not applicable because the applicant's steam and power conversion systems do not contain steel, stainless steel, or copper alloy heat exchanger tubes exposed to raw water. The staff reviewed LRA Sections 2.3 and 3.4 and confirmed that the applicant's LRA does not have any AMR results for the steam and power conversion systems that include steel, stainless steel, and copper alloy heat exchanger tubes exposed to raw water. The staff also noted that a search of the applicant's UFSAR did not find any evidence of steel, stainless steel, and copper alloy heat exchanger tubes in the steam and power conversion systems exposed to raw water. Based on its review of the LRA and UFSAR, the staff confirmed that there are no in-scope steel, stainless steel, and copper alloy heat exchanger tubes exposed to raw water in the steam and power conversion systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.4-1, line item 3.4.1-35 addresses copper alloy greater than 15 percent Zn piping, piping components, and piping elements exposed to closed-cycle cooling water, raw water, or treated water. The GALL Report recommends the use of GALL AMP XI.M33, "Selective Leaching of Materials," to manage the loss of material due to selective leaching for this component group. The applicant stated that this line item is not applicable because the applicant's steam and power conversion systems do not contain copper alloy greater than 15 percent Zn piping, piping components, and piping elements exposed to closed-cycle cooling water, raw water, or treated water. The staff reviewed LRA Sections 2.3 and 3.4 and confirmed that the applicant's LRA does not have any AMR results for the steam and power conversion systems that include copper alloy greater than 15 percent Zn piping, piping components, and piping elements exposed to closed-cycle cooling water, raw water, or treated water. The staff also noted that a search of the applicant's UFSAR did not find any evidence of copper alloy greater than 15 percent Zn piping, piping components, and piping elements in the steam and power conversion systems exposed to closed-cycle cooling water, raw water, or treated water. Based on its review of the LRA and UFSAR, the staff confirmed that there are no in-scope copper alloy greater than 15 percent Zn piping, piping components, and piping elements exposed to closed-cycle cooling water, raw water, or treated water in the steam and power conversion systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.4-1, line item 3.4.1-42 addresses steel piping, piping components, and piping elements exposed to air-indoor controlled (external). The GALL Report does not have a specific AMP recommendation to manage aging because there is no aging effect or mechanism identified in the GALL Report. The applicant stated that this line item is not applicable because the applicant's steam and power conversion systems do not contain steel piping, piping components, and piping elements exposed to air-indoor controlled (external). The staff reviewed LRA Sections 2.3 and 3.4 and confirmed that the applicant's LRA does not have any AMR results for the steam and power conversion systems that include steel piping, piping components, and piping elements exposed to air-indoor controlled (external). The staff also noted that a search of the applicant's UFSAR did not find any evidence of steel piping, piping components, and piping elements in the steam and power conversion systems exposed to air-indoor controlled (external). Based on its review of the LRA and UFSAR, the staff confirmed that there are no in-scope steel piping, piping components, and piping elements exposed to air-indoor controlled (external) in the steam and power conversion systems and, therefore, finds the applicant's determination acceptable.

LRA Table 3.4-1, line item 3.4.1-43 addresses steel and stainless steel piping, piping components, and piping elements exposed to concrete. The GALL Report does not have a specific AMP recommendation to manage aging because there is no aging effect or mechanism identified in the GALL Report. The applicant stated that this line item is not applicable because the applicant's steam and power conversion systems do not contain steel and stainless steel piping, piping components, and piping elements exposed to concrete. The staff reviewed LRA Sections 2.3 and 3.4 and confirmed that the applicant's LRA does not have any AMR results for the steam and power conversion systems that include steel and stainless steel piping, piping components, and piping elements exposed to concrete. The staff also noted that a search of the applicant's UFSAR did not find any evidence of steel and stainless steel piping, piping components, and piping elements in the steam and power conversion systems exposed to concrete. Based on its review of the LRA and UFSAR, the staff confirmed that there are no in-scope steel and stainless steel piping, piping components, and piping elements exposed to concrete in the steam and power conversion systems and, therefore, finds the applicant's determination acceptable.

3.4.2.1.2 Loss of Material Due to General, Pitting, Crevice, Galvanic, and Microbiologically-Influenced Corrosion and Fouling

LRA Table 3.4-1, item 3.4.1-31 addresses the loss of material due to general, pitting, and crevice corrosion and MIC, as well as fouling of steel heat exchanger components exposed to raw water. The applicant proposes to manage these aging effects through its Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and Open-Cycle Cooling Water System Program. The GALL Report recommends that these aging effects be managed through the use of GALL AMP XI.M20, "Open-Cycle Cooling Water System." The applicant proposes that the AMR items are either consistent with the GALL Report in all respects (generic note A) or are consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited (generic note E).

The staff reviewed the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program and Open-Cycle Cooling Water Program, and its evaluations are documented in SER Sections 3.0.3.1.20 and 3.0.3.1.22, respectively.

In its review of LRA components subordinate to LRA item 3.4.1-31, for which the applicant assigned generic note E and for which the applicant proposes to use the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, the staff noted that the applicant selected a GALL Report item for which the Open-Cycle Cooling Water Program was the recommended program. The staff also noted that for these subordinate items, the applicant identified the intended function of the component as leakage boundary (spatial). LRA Table 2.1-1 defines "leakage boundary (spatial)" as applying only to nonsafety-related systems. However, the scope of GALL AMP XI.M20 is limited to components which transfer heat from safety-related systems to the ultimate heat sink. The staff finds the applicant's Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program an appropriate means of managing aging for the components under consideration because the aging effects under consideration, loss of material and fouling, are adequately detected by visual inspection and the applicant’s proposed program contains appropriate visual inspection methods.

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).

3.4.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.4.2, the applicant further evaluates aging management, as recommended by the GALL Report, for the steam and power conversion systems components and provides information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to general, pitting, and crevice corrosion
- loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion and fouling
- reduction of heat transfer due to fouling
- loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion
- cracking due to SCC
- loss of material due to pitting and crevice corrosion
- loss of material due to pitting, crevice, and microbiologically-influenced corrosion
- loss of material due to general, pitting, crevice, and galvanic corrosion
- QA for aging management of nonsafety-related components

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which the report recommends further evaluation, the staff audited and reviewed the applicant’s evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant’s further evaluations against the criteria contained in SRP-LR Section 3.4.2.2.The staff’s review of the applicant’s further evaluation follows.

3.4.2.2.1 Cumulative Fatigue Damage

LRA Section 3.4.2.2.1 states that 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.

3.4.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed LRA Section 3.4.2.2.2 against the following criteria in SRP-LR Section 3.4.2.2.2:

(1) LRA Section 3.4.2.2.2.1 addresses loss of material due to general, pitting, and crevice corrosion in steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water and in steel piping, piping components, and piping elements exposed to steam. The applicant stated that loss of material due to general, pitting, and crevice corrosion in steel and cast iron piping and components exposed to steam or treated water will be managed by the Water Chemistry and confirmed by the One-Time Inspection programs.

The staff reviewed LRA Section 3.4.2.2.2.1 against the criteria described in SRP-LR Section 3.4.2.2.2.1, 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 in steel piping, piping components, and piping elements exposed to steam. The SRP-LR also states that the AMP relies on monitoring and control of water chemistry to mitigate degradation and a one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect does not occur or is progressing very slowly such that the component's intended function will be maintained during the period of extended operation. The GALL Report, under items VIII.A-15, VIII.C-3, VIII.C-6, VIII.D2-7, VIII.E-7, VIII.E-33, and VIII.E-40 recommends managing the aging effect using the Water Chemistry Program augmented by the One-Time Inspection Program to verify the effectiveness of the chemistry control program.

The staff reviewed the LRA and identified in Table 3.4.1, items 3.4.1-2, 3.4.1-4, 3.4.1-5, and 3.4.1-6 that the applicant will use the Water Chemistry and One-Time Inspection programs to manage the loss of material due to general, pitting, and crevice corrosion for these steel components. The staff further reviewed the applicant's Water Chemistry and the One-Time Inspection programs, which are evaluated in SER Sections 3.0.3.1.26 and 3.0.3.1.21, respectively. The applicant stated that the One-Time Inspection Program includes identification of inspection locations which are the most susceptible to the potential corrosion mechanism, selection of the examination technique with acceptance criteria, and evaluation of the results including the need for additional inspections or other corrective actions. The staff finds that the credited programs are appropriate because: (1) the Water Chemistry Program will establish the plant water chemistry control parameters and identify the actions required if the parameters exceed limits and (2) the One-Time Inspection Program will include a one-time inspection of select components to verify the effectiveness of the Water Chemistry Program for managing the effects of aging due to the potential corrosion mechanisms. The staff also finds the applicant's management of the effect of aging acceptable because it requires inspections at appropriate locations (e.g., stagnant low flow). The staff finds that the applicant satisfied the acceptance criteria in SRP-LR Section 3.4.2.2.2.1 and, therefore, the applicant's AMR results are consistent with the ones under GALL Report items VIII.A-15, VIII.C-3, VIII.C-6, VIII.D2-7, VIII.E-7, VIII.E-33, and VIII.E-40.

Based on the program identified, the staff concludes that the applicant's program meets SRP-LR Section 3.4.2.2.2.1 criteria. For those line items that apply to LRA Section 3.4.2.2.2.1, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

(2) LRA Section 3.4.2.2.2.2 refers to Table 3.4-1 item 3.4.1-7 and addresses carbon steel components exposed to lubricating oil. The LRA states that: (1)These components are managed for loss of material due to general, crevice, and MIC by the Lubricating Oil Analysis Program; (2) the Lubricating Oil Analysis Program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion; (3) the effectiveness of the Lubricating Oil Analysis Program will be confirmed by the One-Time Inspection Program; and (4) selected components, including a sample of components where potential water pooling will occur, are inspected to ensure corrosion does not occur.

The staff reviewed LRA Section 3.4.2.2.2.2 against the criteria in SRP-LR Section 3.4.2.2.2.2, which states that loss of material due to general, pitting and crevice corrosion could occur for steel piping, piping components, and piping elements exposed to lubricating oil. SRP-LR Section 3.4.2.2.2.2 further states that: (1) the existing AMP relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion; (2) the GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil chemistry control program; and (3) a one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion does not occur.

The staff reviewed the applicant's Lubricating Oil Analysis and One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.8 and 3.0.3.1.21, respectively, and finds that these programs: (1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material and (2) will perform one-time inspections of select steel piping, piping components, and piping elements in the most susceptible locations exposed to lubricating oil for loss of material due to general, pitting, and crevice corrosion to verify the effectiveness of the applicant's Lubricating Oil Analysis Program in applicable steam and power systems. The staff noted that the GALL Report states that one-time inspection is an acceptable method to verify the effectiveness of a mitigative AMP such as the Lubricating Oil Analysis Program. The staff noted that the applicant is crediting the Lubricating Oil Analysis Program as recommended in the GALL Report AMR, and the applicant is verifying effectiveness of the Lubricating Oil Analysis Program with the elements of the One-Time Inspection Program. The staff finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.2.2.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.2.2 criteria. For those line items that apply to LRA Section 3.4.2.2.2.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the above, the staff concludes that the applicant meets SRP-LR Section 3.4.2.2.2 criteria. 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).

3.4.2.2.3 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion and Fouling

The staff reviewed LRA Section 3.4.2.2.3 against the criteria in SRP-LR Section 3.4.2.2.3.

LRA Section 3.4.2.2.3 addresses loss of material due to general, pitting, and crevice corrosion, MIC, and fouling in steel piping, piping components, and piping elements exposed to raw water. The applicant stated that this item is not applicable because the steam and power conversion system has no steel piping, piping components, or piping elements in a raw water environment. Based on information in the UFSAR, the staff confirmed that the applicant’s plant does not have steel piping, piping components, and piping elements exposed to raw water. Therefore, the staff finds that this item is not applicable.

3.4.2.2.4 Reduction of Heat Transfer Due to Fouling

The staff reviewed LRA Section 3.4.2.2.4 against the following criteria in SRP-LR Section 3.4.2.2.4:

(1) LRA Section 3.4.2.2.4.1 addresses reduction of heat transfer due to fouling in stainless steel and copper alloy heat exchanger tubes exposed to treated water. The applicant stated that the steam and power conversion system has no stainless steel or copper alloy heat exchanger tubes in a treated water environment. The applicant also stated that the aging-effect and aging-mechanism combination is applicable to the HPCI and RCICS in the ESFs group, which contain copper alloy heat exchanger tubes exposed to treated water. The reduction of heat transfer due to fouling in the copper alloy heat exchanger tubes in a treated water environment will be managed by the Water Chemistry Program and the effectiveness will be confirmed by the One-Time Inspection Programs.

The staff reviewed LRA Section 3.4.2.2.4.1 against the criteria described in SRP–LR Section 3.4.2.2.4.1, which states that reduction of heat transfer due to fouling could occur for stainless steel and copper alloy heat exchanger tubes exposed to treated water. The SRP-LR also states that the AMP relies on monitoring and control of water chemistry to mitigate degradation, and a one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect does not occur or is progressing very slowly such that the component’s intended function will be maintained during the period of extended operation. The GALL Report, under item VIII.E-10, recommends managing the aging effect using the Water Chemistry Program augmented by the One-Time Inspection Program to verify the effectiveness of the Chemistry Control Program.

The staff reviewed LRA Section 3.4.2.2.4.1 and noted that two items contained in LRA Tables 3.2.2-2 and 3.2.2-4 are associated with item 3.4.1-9. Both components are designated heat exchanger, condenser, cooler, fan coil. Both items are admiralty brass and are exposed to treated water. The AMPs for the components in Table 3.2.2-2 are the Water Chemistry Program and the One-Time Inspection Program. The AMPs for the components in Table 3.2.2-4 are the Lubricating Oil Analysis Program and One-Time Inspection Program. It is unclear to the staff whether the applicant actually proposes to manage the aging of the component which is exposed to water with the Lubricating Oil

Analysis Program or whether the applicant erred in designating the proposed AMP, or whether the applicant erred in designating the environment. By letter dated November 13, 2009, the staff issued RAI 3.4.2.2.4.1-1 requesting that the applicant clarify the use of the Lubricating Oil Analysis Program for components exposed to treated water.

In its response dated December 14, 2009, the applicant stated that the use of the Lubricating Oil Analysis Program was incorrect and that LRA table 3.2.2-4 had been corrected to show the use of the Water Chemistry and One-Time Inspection Programs. The staff finds the applicant’s response acceptable because the item under consideration is now consistent (i.e., the environment and program are in agreement, and are consistent with the GALL Report). The staff’s concern described in RAI 3.4.2.2.4.1-1 is resolved.

LRA Table 3.2.2-2 addresses the AMR item of reduction of heat transfer due to fouling in the admiralty brass components of the HPCI system in the ESFs. The applicant stated that the component type of the AMR item is “Heat exchanger, condenser, cooler, fan coil.”

LRA Table 3.2.2-4 also addresses the AMR item of reduction of heat transfer due to fouling in the admiralty brass components of the RCIC system of the ESFs. The component type of the AMR item is “Heat exchanger, condenser, cooler, fan coil.” The applicant stated that the components of the AMR item are exposed to treated water (internal) and related to LRA Table 3.4-1, item 3.4.1-9 that requires further evaluation of detection of aging effects in the similar manner with the foregoing AMR item addressed in LRA Table 3.2.2-2. The applicant also stated that the consistency note for the AMR item is note A.

However, the staff noted that the applicant credits the Lubricating Oil Analysis Program and the One-Time Inspection Program in contrast with the consistency note A the applicant claimed for the AMR item. By letter dated November 13, 2009, the staff issued RAI 3.3.2.2-2, requesting that the applicant clarify why the Lubricating Oil Analysis Program is credited for the AMR item instead of the Water Chemistry Program, in contrast with the consistency note A that the applicant claimed.

In its response, by letter dated December 14, 2009, the applicant stated the Lubricating Oil Analysis Program was listed in error and the correct programs for the AMR item are the Water Chemistry Program and the One-Time Inspection Program. Accordingly, the AMP is changed from the Lubricating Oil Analysis Program to the Water Chemistry Program.

Based on its review, the staff finds the applicant’s response to RAI 3.3.2.2-2, acceptable because the applicant confirms that its reference to the Lubricating Oil Analysis Program for the AMR item was made in error and the relevant AMPs are the One-Time Inspection Program and the Water Chemistry Program, and the programs credited for aging management are consistent with the GALL Report. The staff’s concern described in RAI 3.3.2.2-2 is resolved.

The staff reviewed the LRA and identified in Table 3.4-1, item 3.4.1-9, as well as Tables 3.2.2-2 and 3.2.2-4, that the applicant will use the Water Chemistry and the One-Time Inspection Programs to manage the reduction of heat transfer due to fouling in the copper alloy heat exchanger tubes in treated water. The staff further reviewed the applicant’s Water Chemistry and the One-Time Inspection Programs, which are evaluated in SER Sections 3.0.3.1.26 and 3.0.3.1.21, respectively. The applicant stated that the One-Time Inspection Program includes identification of inspection locations which are the most susceptible to the potential corrosion mechanism, selection of the examination technique with acceptance criteria, and evaluation of the results including the need for additional inspections or other corrective actions. The staff finds that the credited programs are appropriate because: (1) the Water Chemistry Program will establish the plant water chemistry control parameters and identify the actions required if the parameters exceed limits, and (2) the One-Time Inspection Program will include a one-time inspection of select components to verify the effectiveness of the Water Chemistry Program for managing the effects of aging due to the potential corrosion mechanisms. The staff also finds the applicant's management of the effect of aging acceptable because it requires inspections at appropriate locations (e.g., stagnant low flow). The staff finds that the applicant satisfied the acceptance criteria in SRP-LR Section 3.4.2.2.4.1 and, therefore, the applicant's AMR results are consistent with the GALL Report item VIII.E-10.

LRA Section 3.4.2.2.4.1 addresses reduction of heat transfer due to fouling in stainless steel and copper alloy heat exchanger tubes exposed to treated water. The applicant stated that this item is not applicable because the steam and power conversion system has no steel piping, piping components, or piping elements in a treated water environment. Based on information in the UFSAR, the staff confirmed that the applicant's plant does not have stainless steel and copper alloy heat exchanger tubes exposed to treated water. Therefore, the staff finds that this item is not applicable.

Based on the programs identified and its review results, the staff concludes that the applicant's programs meet the criteria of SRP-LR Section 3.4.2.2.4.1. For the AMR items that apply to LRA Section 3.4.2.2.4.1, the staff determines that the LRA is consistent with the GALL Report and 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, as required by 10 CFR 54.21(a)(3).

(2) LRA Table 3.4-1, item 3.4.1-10 addresses reduction of heat transfer due to fouling in steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil. The applicant stated that this item is not applicable because the steam and power conversion system does not have stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil. The staff reviewed the UFSAR to verify the design of the steam and power conversion system. Based on information in the UFSAR, the staff confirmed that the applicant's plant does not have stainless steel, and copper alloy heat exchanger tubes in the steam and power conversion system Therefore, the staff finds that this item is not applicable.

Based on the above, the staff concludes that the line item is not applicable.

Based on the above, the staff concludes that the applicant meets SRP-LR Section 3.4.2.2.4 criteria. 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).

3.4.2.2.5 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion

The staff reviewed LRA Section 3.4.2.2.5 against the following criteria in SRP-LR Section 3.4.2.2.5:

(1) LRA Section 3.4.2.2.5.1 addresses loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion that could occur in steel (with or without coating or wrapping) piping, piping components, piping elements, and tanks exposed to soil. The applicant stated that the steam and power conversion systems have no carbon steel components that are exposed to soil.

The staff reviewed LRA Section 3.4.2.2.5.1 against the criteria in SRP-LR Section 3.4.2.2.5.1, which states that loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion 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 operating experience to manage the effects of loss of material from general, pitting, crevice, and microbiologically-influenced corrosion. The GALL Report also states that the effectiveness of the Buried Piping and Tanks Inspection Program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material does not occur.

In its review of LRA Section 3.4.2.2.5.1, 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 no subordinate items exist, nor any AMR line items associated with soil and steel. The staff also noted that a search of the applicant's UFSAR failed to find any evidence of steel components exposed to soil in the steam and power conversion system.

The staff concludes that the components addressed by this AMR item do not exist and that this item is not applicable.

(2) LRA Section 3.4.2.2.5.2 refers to Table 3.4-1 item 3.4.1-12 and addresses loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion for carbon steel heat exchanger components exposed to lubricating oil. The LRA states that these components are managed by the Lubricating Oil Analysis Program. The LRA further states that this program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion, and that the One-Time Inspection Program will use representative samples to confirm that the Lubricating Oil Analysis Program has been effective at managing aging effects for components crediting this program.

The staff reviewed LRA Section 3.4.2.2.5.2 against the criteria in SRP-LR Section 3.4.2.2.5.2, which states that loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion could occur in steel heat exchanger components exposed to lubricating oil. SRP-LR Section 3.4.2.2.5.2 further states that: (1) the existing AMP relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion; and (2) the effectiveness of lubricating oil contaminant control can be achieved through a one-time inspection of selected components at susceptible locations.

The staff reviewed the applicant's Lubricating Oil Analysis and One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.8 and 3.0.3.1.21, respectively, and finds that these programs: (1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material due to general, pitting, and crevice corrosion; and (2) will perform one-time inspections of select steel heat exchanger tubing exposed to lubricating oil for loss of material due to general, pitting, and crevice corrosion to verify the effectiveness of the Lubricating Oil Analysis Program in applicable steam and power conversion systems. The staff noted that the applicant does not specifically manage loss of material due to MIC; however, the control of contaminants in the lubrication oil, in conjunction with the One-Time Inspection Program, will manage the aging effect and loss of material, regardless of the aging mechanism. The staff noted that the GALL Report states that one-time inspection is an acceptable method to verify the effectiveness of a mitigative AMP such as the Lubricating Oil Analysis Program. The staff noted that the applicant is crediting the Lubricating Oil Analysis Program as recommended in the GALL Report and the applicant is verifying effectiveness of the Lubricating Oil Analysis Program with the elements of the One-Time Inspection Program. The staff finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.5.2.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.5.2 criteria. For those line items that apply to LRA Section 3.4.2.2.5.2, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the above, the staff concludes that the applicant meets SRP-LR Section 3.4.2.2.5 criteria. 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).

3.4.2.2.6 Cracking Due to Stress Corrosion Cracking

LRA Section 3.4.2.2.6 addresses SCC of stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water greater than 60 °C [140 °F]. The LRA also addresses stainless steel piping, piping components, and piping elements exposed to steam. The LRA indicates that the SCC of these components will be managed by the Water Chemistry Program augmented by the One-Time Inspection Program.

The staff reviewed LRA Section 3.4.2.2.6 against the criteria in SRP-LR Section 3.4.2.2.6, which states that SCC can potentially occur for stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water greater than 60 °C [140 °F], and for stainless steel piping, piping components, and piping elements exposed to steam. The SRP-LR states that the existing AMP typically relies on monitoring and control of water chemistry. The GALL Report recommends verifying the effectiveness of the Water Chemistry Program with a one-time inspection of selected components at susceptible locations to ensure SCC does not occur and that these components' intended functions will be maintained during the period of extended operation.

By letter dated March 9, 2010, the applicant amended its LRA such that the main steam flow restrictors (Class 1 flow element) reference LRA Table 3.4-1, item 3.4.1-13. The staff noted that for the main steam flow restrictors the applicant has credited its Water Chemistry Program and One-Time Inspection Program to manage cracking due to SCC.

The staff reviewed LRA Table 3.4-1, items 13 and 14 and determined they are consistent with SRP-LR Section 3.4.2.2.6 because the aging issue will be managed by the Water Chemistry Program and the One-Time Inspection Program. The staff reviewed the applicant's Water Chemistry Program and One-Time Inspection Program, which are evaluated in SER Sections 3.0.3.1.26 and 3.0.3.1.21, respectively. The staff noted that the applicant's Water Chemistry Program includes the control of certain water chemistry control parameters and identifies the actions required if the parameters exceed limits in order to mitigate SCC. The staff noted that the applicant's One-Time Inspection Program includes inspection methods that may consist of visual, surface, or volumetric examinations or other established NDE techniques, which will be able to assess SCC. The staff determined that this program includes activities that are consistent with the GALL Report's recommendations and that the program is adequate to manage SCC of stainless steel components exposed to either treated water greater than 60 °C [140 °F] or steam.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.6 criteria. For those items that apply to Section 3.4.2.2.6, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.4.2.2.7 Loss of Material Due to Pitting and Crevice Corrosion

The staff reviewed LRA Section 3.4.2.2.7 against the following criteria in SRP-LR Section 3.4.2.2.7:

(1) LRA Section 3.4.2.2.7.1 addresses loss of material due to pitting and crevice corrosion that could occur in 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 applicant stated that aluminum alloy, copper, copper alloy, and stainless steel piping components exposed to treated water are managed for loss of material due to pitting and crevice corrosion by the Water Chemistry Program. 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 this program, including susceptible locations, such as areas of low or stagnant flow and areas of high concentrations of impurities. The applicant further stated that the stainless steel and copper alloy components exposed to treated water or steam are being managed for crevice and pitting corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. This AMP is used to assure, through visual inspections, that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions.

    The staff reviewed LRA Section 3.4.2.2.7.1 against the criteria in SRP-LR Section 3.4.2.2.7.1, 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 AMP relies on monitoring and control of water chemistry to manage the effects of loss of material due to pitting and crevice corrosion. However, control of water chemistry does not preclude corrosion at locations of stagnant flow conditions. Therefore, the GALL Report recommends that the effectiveness of the water chemistry program should be verified to ensure that corrosion does not occur. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that corrosion does not occur and that the component's intended function will be maintained during the period of extended operation.

LRA Tables 3.3.2-21 and 3.3.2-31 address the AMR items of loss of material due to pitting and crevice corrosion in the copper alloy components of the reactor building and radwaste building sampling system and the turbine building sampling system of the auxiliary systems, respectively. The applicant stated that the types of components in the reactor building and radwaste building sampling system are "Instrumentation, indication/recorder (level gauge)," and "Valve, damper" and the types of the components in the turbine building sampling system are "Filter, screens, strainer." "Instrumentation, indication/recorder (level gauge)" and "Valve, damper." In addition, LRA Tables 3.4.2-2, 3.4.2-3 and 3.4.2-5 address the AMR items of loss of material due to pitting and crevice corrosion in the copper and copper alloy components of the condensate and feed water system, condenser and condenser air removal system and turbine components and commodity groups, respectively. The applicant stated that the component types of the AMR items are "Pipe, pipe fittings, hoses, tubes, rupture disk," "Valve, damper," and "Level gage."

The applicant further stated that the consistency note for the AMR items is note A, which means that the AMR item is consistent with the GALL Report for component, material, environment and aging effect and the applicant's AMP is consistent with the GALL AMP. The staff noted that where the GALL Report recommends GALL AMP XI.M2, "Water Chemistry" and GALL AMP XI.M32, "One-Time Inspection" for acceptable verification of the water chemistry program effectiveness, the applicant consistently credits the Water Chemistry Program and the One-Time Inspection Program. The staff also reviewed the AMR items in comparison with GALL Report Volume 2, item VIII.A-5 and finds that the consistency note A that the applicant claimed is adequate for the AMR items in comparison with the GALL Report AMR item as described above.

The staff reviewed the applicant's Water Chemistry Program and One-Time Inspection Program The staff's evaluations are documented in SER Sections 3.0.3.1.26 and 3.0.3.1.21, respectively.

In its review, the staff also finds the Water Chemistry Program is capable of mitigating fouling that can cause the reduction in heat transfer for the copper alloy components. The staff noted that the AMP controls water chemistry to minimize the environmental degradation of the components by maintaining the relevant water chemistry that may cause fouling. The staff also finds that the One-Time Inspection Program, which performs inspections of selected components, is capable of detecting fouling that can cause the reduction in heat transfer, if it should occur in the selected components. On the basis of its review, the staff determines that the One-Time Inspection Program is adequate to verify that the aging effects are not occurring in the components so that the intended functions are maintained for the period of extended operation.

However, the staff noted that LRA Table 3.3.2-1 addresses the AMR items of loss of material due to pitting and crevice corrosion in the copper alloy (bronze) components of the auxiliary heating boiler system. The applicant stated that the component types are "Instrumentation (level gage)" and "Valve, damper." The applicant stated that the consistency note for the AMR items is note E, which means that the material, environment, and aging effect are consistent with the GALL Report, but a different AMP is credited. The staff noted that the applicant credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

The staff required additional information to clarify whether water chemistry control is performed to minimize the adverse effect of the treated water environment on loss of material in the components of the auxiliary heating boiler as recommended in the GALL Report. By letter dated November 13, 2009, the staff issued RAI 3.3.2.2-3 requesting the applicant clarify whether water chemistry control is performed to minimize the adverse effect of the environment on the component degradation. The staff also requested that if water chemistry control is not performed to minimize the environmental effect on loss of material in the components the applicant should justify why the applicant's aging management approach is adequate to manage the aging effects without water chemistry control.

In its response by letter dated December 14, 2009, the applicant stated as discussed in the response to RAI 3.3.2.2-1, GALL AMP XI.M2 that the applicant's Water Chemistry Program applies to water chemistry control of reactor water and systems which communicate with the reactor. The auxiliary heating boiler does not contain reactor water and does not communicate with the reactor. GALL Report item VIII.A-5 was chosen because of the structure, material, and environment match, not because the auxiliary boiler is part of the steam turbine system. The applicant stated that the water chemistry control for the auxiliary heating boiler and heat loop is maintained in accordance with plant chemistry procedures. Furthermore, the Inspection of the Internal Surfaces in Miscellaneous Piping and Ducting Components Program was chosen for aging management of the auxiliary heating boiler system because it is the most appropriate program for this system.

In addition, by letter dated November 13, 2009, the staff issued RAI BF75-1 to obtain details as to what AMP will be used to manage these AMR issues and why this program was selected instead of the program recommended in the GALL Report. In its response dated December 14, 2009, the applicant stated that, at DAEC, certain copper alloy components exposed to treated water environment are being managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program rather than the Water Chemistry Program specified in the GALL Report. The applicant also stated that the program will visually inspect affected components to ensure that existing environmental conditions are not causing metal degradation and that the component's intended functions are maintained during the period of extended operation. The applicant further stated that the GALL Report XI.M2 Water Chemistry Program for boiling water reactors specifies the use of EPRI guidelines to maintain the water chemistry in the reactor water systems directly connected to the reactor, the feedwater and condensate systems, and CRD system. The water quality in the steam and power conversion systems is not maintained to the same standards as reactor water. The treated water used in these systems is supplied by the demineralized water systems. Water chemistry controls are in place for these systems to maintain the purity of this treated water to minimize internal corrosion.

The staff noted that the applicant clarified that: (1) water chemistry control for the auxiliary heating boiler and heat loop is maintained in accordance with plant chemistry procedures, (2) the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program includes visual inspections to ensure that the aging effects are adequately managed, and (3) the chemistry control of the treated water in the auxiliary heating boiler is not within the scope of GALL AMP XI.M2. The staff's review of the Inspection of the Internal Surfaces of Miscellaneous Piping and Ducting Components Program and its evaluation is documented in SER Section 3.0.3.1.20. In its review, the staff determines that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program can manage loss of material for the copper and copper alloy AMR items exposed to condensation because the periodic inspections of the internal surfaces of the components can detect the aging effect of the AMR items and the maintenance activities of the program can adequately maintain the intended functions of the components.

Based on its review, the staff finds that the applicant's response to RAI 3.3.2.2-3 and BF75-1 is acceptable because the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program ensures that existing environmental conditions are not causing the degradation of the components that could result in a loss of the intended function of the components and the chemistry control can prevent or mitigate the aging effect of loss of material. The staff's concerns described in RAI 3.3.2.2-3 and RAI BF75-1 are resolved.

Based on the programs identified, the staff concludes that the applicant's programs meet the criteria of SRP-LR Section 3.4.2.2.7.1. For those line items that apply to LRA Section 3.4.2.2.7.1, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that 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).

(2) LRA Section 3.4.2.2.7.2 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 stated that stainless steel piping exposed to soil is managed for loss of material due to pitting and crevice corrosion by the Buried Piping and Tanks Inspection Program. The applicant also stated that plant inspection frequency and operating experience validate that the Buried Piping and Tanks Inspection Program is working to manage loss of material. The applicant further stated that at any time when underground components are uncovered (whether anticipated or unplanned) and there are any indications of degradation, corrosion, damage, etc., the appropriate personnel shall be notified to inspect the condition of the equipment.

The staff reviewed LRA Section 3.4.2.2.7.2 against the criteria in SRP-LR Section 3.4.2.2.7.2, 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 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 this SRP-LR.)

The staff reviewed the applicant's Buried Piping and Tanks Inspection Program and its evaluation is documented in SER Sections 3.0.3.1.7.

The staff reviewed items subordinate to LRA Table 3.4-1, item 3.4.1-17 and noted that the applicant proposes that the AMR items associated with Table 3.4.1, item 17 are fully consistent with the GALL Report except a different AMP is credited (generic note E). The staff also noted that the LRA AMP includes stainless steel while the GALL Report AMP does not. The staff further noted that the LRA AMP is sufficient to adequately manage the aging of stainless steel because it contains acceptable inspection procedures and frequencies, and that the issue of consistency between the Buried Piping and Tanks Inspection Program and the GALL AMP XI.M34 will be addressed as part of the evaluation of the GALL AMP XI.M34. In its audit of the applicant’s Buried Piping and Tanks Inspection Program, the staff found no operating history which would indicate a need for a change to the Buried Piping and Tanks Inspection Program. The staff finds that the LRA AMP is sufficient to adequately manage the aging of stainless steel because it contains appropriate inspection procedures to visually examine the exterior surfaces of the steel piping for loss of material due to pitting or crevice corrosion at intervals consistent with the GALL Report AMP. The LRA AMP satisfies the acceptance criteria in SRP-LR 3.4.2.2.7.2 and, therefore, the applicant’s AMR results are consistent with the ones under GALL Report, item VIII.E-28.

Based on the programs identified, the staff concludes that the applicant’s programs meet the criteria of SRP-LR Section 3.4.2.2.7.2. For those line items that apply to LRA Section 3.4.2.2.7.2, 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 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) LRA Section 3.4.2.2.7.3 refers to Table 3.4-1 item 3.4.1-18 and addresses copper alloy piping and components exposed to lubricating oil. The LRA states that these components are managed for loss of material due to pitting and crevice corrosion by the Lubricating Oil Analysis Program which includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion; and further states that the effectiveness of the Lubricating Oil Analysis Program will be confirmed by the One-Time Inspection Program, using a sample of components where potential water pooling will occur, to ensure corrosion does not occur.

The staff reviewed LRA Section 3.4.2.2.7.3 against the criteria in SRP-LR Section 3.4.2.2.7.3, which states that loss of material due to pitting and crevice corrosion could occur for copper alloy piping, piping components, and piping elements exposed to lubricating oil. The existing AMP relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. SRP-LR Section 3.4.2.2.7.3 further states that the effectiveness of lubricating oil contaminant control can be verified through a one-time inspection of selected components at susceptible locations, and that one-time inspection is an acceptable method to ensure that corrosion does not occur.

The staff reviewed the applicant’s Lubricating Oil Analysis and One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.2.8 and 3.0.3.1.21, respectively. The staff finds that these programs: (1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material due to pitting and corrosion; and (2) will perform one-time inspections of select copper alloy piping, piping components, and piping elements exposed to lubricating oil for loss of material due to pitting and crevice corrosion to verify the effectiveness of the

Lubricating Oil Analysis Program in applicable steam and power conversion systems. The staff noted that the GALL Report states that one-time inspection is an acceptable method to verify the effectiveness of a mitigative AMP such as the Lubricating Oil Analysis Program. The staff noted that the applicant is crediting the Lubricating Oil Analysis Program as recommended in the GALL Report and the applicant is verifying effectiveness of the Lubricating Oil Analysis Program with the elements of the One-Time Inspection Program. The staff finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.7.3.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.7.3 criteria. For those line items that apply to LRA Section 3.4.2.2.7.3, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.4.2.2.7 criteria. For those line items that apply to LRA Section 3.4.2.2.7, the staff determines that the LRA is consistent with the GALL Report and that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.4.2.2.8 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion

LRA Section 3.4.2.2.8 refers to Table 3.4-1 item 3.4.1-19 and addresses stainless steel piping and components exposed to lubricating oil. The LRA states that these components are managed for loss of material due to pitting, crevice, and microbiologically-influenced corrosion by the Lubricating Oil Analysis Program, which includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The applicant stated that the effectiveness of the Lubricating Oil Analysis Program will be confirmed by the One-Time Inspection Program, where selected components, including a sample of components where potential water pooling will occur, are inspected to ensure corrosion does not occur.

The staff reviewed LRA Section 3.4.2.2.8 against the criteria in SRP-LR Section 3.4.2.2.8, which states that loss of material due to pitting, crevice, and microbiologically-influenced corrosion could occur in stainless steel piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil. SRP-LR Section 3.4.2.2.8 further states that: (1) the existing AMP relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion, and (2) the effectiveness of lubricating oil contaminant control can be verified through a one-time inspection of selected components at susceptible locations to ensure that corrosion does not occur.

The staff reviewed the applicant's Lubricating Oil Analysis and One-Time Inspection programs and its evaluations are documented in SER Sections 3.0.3.2.8 and 3.0.3.1.21, respectively. The staff finds that these programs: (1) provide for periodic sampling of lubricating oil to maintain contaminants at acceptable limits to preclude loss of material due to pitting and crevice corrosion; and (2) will perform one-time inspections of select stainless steel piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil for loss of material due to pitting and crevice corrosion in order to verify the effectiveness of the Lubricating Oil Analysis Program in applicable steam and power conversion systems. The staff noted that the GALL Report states that one-time inspection is an acceptable method of verifying the effectiveness of a mitigative AMP such as the Lubricating Oil Analysis Program. The staff finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.8.

Based on the programs identified, 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, as required by 10 CFR 54.21(a)(3).

3.4.2.2.9 Loss of Material Due to General, Pitting, Crevice, and Galvanic Corrosion

LRA Section 3.4.2.2.9 refers to Table 3.4-1 item 3.4.1-5 and addresses steel heat exchanger components exposed to treated water. The LRA states that these components are being managed for general, pitting and crevice corrosion by the Water Chemistry Program and that the effectiveness of the Water Chemistry Program is verified using the One-Time Inspection Program. The applicant stated that selected components, including a sample of components where the flow of water is low or stagnant conditions exist and creviced areas of high impurity concentrations, are inspected to determine whether or not an aging effect is occurring or is progressing very slowly such that the components intended function will be maintained during the period of extended operation.

The staff reviewed LRA Section 3.4.2.2.9 against the criteria in SRP-LR Section 3.4.2.2.9, which states that the existing AMP relies on monitoring and control of water chemistry to manage the effects of loss of material due to general, pitting, and crevice galvanic corrosion. However, control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations of stagnant flow conditions and, therefore, the effectiveness of the Water Chemistry Control Program should be verified to ensure that corrosion does not occur. The staff noted that the GALL Report recommends further evaluation of programs to verify the effectiveness of the Water Chemistry Control Program, where a one-time inspection of select components and susceptible locations is an acceptable method to ensure that corrosion does not occur and that the component's intended function will be maintained during the period of extended operation.

The staff reviewed the applicant's Water Chemistry Program and One-Time Inspection Program and its evaluations are documented in SER Sections 3.0.3.1.26 and 3.0.3.1.21, respectively. The staff finds that these programs: (1) provide for periodic sampling of treated water to maintain contaminants at acceptable limits to preclude loss of material due to general, pitting, crevice and galvanic corrosion; and (2) will perform one-time inspections of selected steel heat exchanger components exposed to treated water for loss of material due to general, pitting, crevice and galvanic corrosion to verify the effectiveness of the Water Chemistry Program in applicable steam and power systems. The staff finds that the applicant satisfied the acceptance criteria in SPR-LR Section 3.4.2.2.9 and, therefore, the applicant's AMR results are consistent with the criteria of the GALL Report item VIII.E-7.

Based on the programs identified, 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 Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.4.2-1 through 3.4.2-5 the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

In LRA Tables 3.4.2-1 through 3.4.2-5, the applicant indicated, via notes F through J, that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 Stainless Steel Fasteners, Bolting, Washers, and Nuts Exposed to Air-Indoor Uncontrolled (External)

LRA Tables 3.4.2-1 through 3.4.2-5 state that stainless steel fasteners, bolting, washers, and nuts exposed to air-indoor uncontrolled (external) have an aging effect of loss of preload and that the aging effect is managed by the Bolting Integrity Program. The applicant cited note F, indicating that the material is not in the GALL Report for this component.

The staff reviewed all AMR result lines (unique items) in the GALL Report where the component type is bolting and confirmed that there are no entries for bolting material made of stainless steel exposed to air-indoor uncontrolled (external) where the aging effect is loss of preload. This review confirmed that the applicant's use of note F is acceptable.

The staff noted that the mechanisms identified in the GALL Report to cause loss of preload in carbon steel or low alloy bolting material (thermal effects, gasket creep, and self-loosening) can also cause loss of preload in stainless steel bolting. The staff also noted that activities in the

Bolting Integrity Program that manage the aging effect of loss of preload are equally effective for carbon steel and stainless steel bolts. The staff further noted that the GALL Report (item VIII.H-5 (S-33)) recommends using the Bolting Integrity Program to manage the aging effect of loss of preload in carbon steel bolts exposed to air-indoor uncontrolled. On the basis that the Bolting Integrity Program's activities for managing loss of preload are applicable for both carbon steel and stainless steel bolts and the GALL Report recommends the Bolting Integrity Program for managing loss of preload in carbon steel bolting, the staff finds the applicant's use of the Bolting Integrity Program to manage loss of preload in stainless steel bolts exposed to air-indoor uncontrolled 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, as required by 10 CFR 54.21(a)(3).

3.4.2.3.2 Stainless Steel Fasteners, Bolting, Washers, and Nuts Exposed to Atmosphere/Weather (External)

LRA Table 3.4.2-1 states that stainless steel fasteners, bolting, washers, and nuts exposed to atmosphere/weather (external) have an aging effect of loss of preload and that the aging effect is managed by the Bolting Integrity Program. For the stainless steel components, the AMR line items cite note F, indicating that the material is not in the GALL Report for this component.

The staff evaluated the applicant's use of note F for stainless steel bolting in atmosphere/weather by reviewing the GALL Report, Volume 2, Chapter VIII, Section H, "External Surfaces of Components and Miscellaneous Bolting for Steam and Power Conversion System," and noting that there are no AMR results shown for bolting material made of stainless steel. Based on its review, the staff confirmed that the applicant's use of note F is acceptable.

During its review, the staff noted that because it is in an intermittently wetted environment, stainless steel bolting exposed to atmosphere/weather may have the potential for pitting or crevice corrosion that could lead to material loss. By letter dated November 13, 2009, the staff issued RAI Table 3.4.2-1-01 requesting that the applicant explain why loss of material due to pitting or crevice corrosion was not identified as an AERM for stainless steel bolting exposed to atmosphere/weather.

In its response dated December 14, 2009, the applicant stated that pitting and crevice corrosion are strongly dependent on the presence of aggressive chemical species such as halides or sulfates, and that contaminants that are present in the atmosphere can be further concentrated due to alternate wetting and drying. The applicant further stated that in stainless steel components, loss of material due to pitting and crevice corrosion is a concern only for plants that are exposed to aggressive species such as salt air, sulfur dioxide, or acid rain contained within the atmosphere/weather environment and that precipitation tends to wash a surface rather than concentrate contaminants. The applicant stated that the site is located in a rural area with a mild atmosphere/weather environment and that the plant is not exposed to salt air or to industrial pollutants which could create aggressive environments. The applicant also stated that it does not have any plant-specific operating experience that suggests a concern with pitting or crevice corrosion of stainless steel components exposed to an atmosphere/weather environment.

The staff reviewed the applicant's response together with AMR results in the GALL Report where the environment is outdoor air. The staff noted that the GALL Report does not identify any aging effects for stainless steel components exposed to an outdoor air environment. The staff noted in the applicant's response that the plant is located in a rural, inland area and not exposed to salt air or industrial pollutants; the staff also noted that the applicant has no plant-specific experience suggesting that stainless steel components exposed to its ambient outdoor air will have a loss of material due to pitting or crevice corrosion.

Based on its review of the GALL Report together with the applicant's response, including the applicant's discussion of plant-specific operating experience, the staff determined that loss of material due to pitting and crevice corrosion is not expected in stainless steel bolting exposed to atmosphere/weather conditions at the applicant's plant. The staff finds the applicant's response to RAI Table 3.4.2-1-01 acceptable, as described above. The staff's concern described in RAI Table 3.4.2-1-01 is resolved.

The staff noted that the same mechanisms that cause loss of preload in carbon steel or low alloy bolting material can also cause loss of preload in stainless steel bolting. The staff also noted that activities in the Bolting Integrity Program that manage the aging effect of loss of preload are not dependent on the bolting material and are equally effective for carbon steel and stainless steel bolts. The staff further noted that the GALL Report (item VIII.H-5 (S-33)) recommends using the Bolting Integrity Program to manage the aging effects of loss of preload in carbon steel bolts. On the basis that the Bolting Integrity Program's activities for managing loss of preload are applicable for both carbon steel and stainless steel bolts, the staff finds the applicant's use of the Bolting Integrity Program to manage loss of preload in stainless steel bolts 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, as required by 10 CFR 54.21(a)(3).

3.4.2.3.3 CPVC Pipe, Pipe Fittings, Hoses, Tubes, Rupture Disks or Valves, or Dampers Exposed to Air-Indoor Uncontrolled (External) and to Treated Water (Internal)

LRA Table 3.4.2-1 states that pipe, pipe fittings, hoses, tubes, rupture disks or valves, or dampers made of chlorinated polyvinyl chloride (CPVC) exposed to air-indoor uncontrolled (external) and to treated water (internal) does not have an AERM and that no AMP is needed. The AMR line items cite note J, indicating that the component, material, and environment combinations are not evaluated in the GALL Report.

The staff noted that the evaluated components are in the condensate and demineralized water system, which is not a high temperature and high pressure system. The staff also noted that the LRA states that the intended functions of the subject components is to maintain mechanical and structural integrity and provide a leakage boundary to prevent spatial interaction with safety-related components. The staff further noted that although the general component grouping includes hoses, tubes and rupture disks, valves, and dampers, the actual components subject to the AMR evaluation are PVC pipe, pipe fittings, and valves. The staff confirmed that the components are used in applications where sustained exposure to UV light, high radiation, and ozone concentrations is not expected.

CPVC is a thermoplastic produced by chlorination of PVC resins. It shares most of the features and properties of PVC, but it is more ductile and somewhat stronger. Based on its review of technical literature (e.g., Roff, W.J., *Fibres, Plastics, and Rubbers: A Handbook of Common Polymers*, Academic Press Inc., New York, 1956) and current industry research and operating experience related to CPVC pipe, pipe fittings, and valves, the staff has determined that, in the absence of specific environmental stressors (e.g., UV light, high radiation, or ozone concentrations), CPVC piping components do not exhibit aging effects of concern. The staff has determined that for CPVC pipe, pipe fittings, and valves with an external environment of “air-indoor uncontrolled” and an internal environment of treated water, there are no AERMs to prevent degradation of mechanical or structural integrity of the components during the period of extended operation. On the basis that the subject components will maintain mechanical and structural integrity so as to provide a leakage boundary during the period of extended operation, the staff finds the applicant’s AMR results for these components, indicating that there is no AERM and no AMP is needed, 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, as required by 10 CFR 54.21(a)(3).

3.4.2.3.4 Stainless Steel Exposed to Atmosphere/Weather (External), No Aging Effect, No Aging Management Program

LRA Table 3.4.2-1 summarizes results of AMRs for the condensate and demineralized water system. In LRA Table 3.4.2-1, the applicant stated that for stainless steel pipe, pipe fittings, hoses, tubes, rupture disk, valves, accumulator, low pressure tank and pulsation dampers exposed to an atmosphere/weather (external) environment, there are no AERMs. The applicant referenced Footnote G for this line item indicating that the environment is not listed in the GALL Report for this material and component combination.

The staff evaluated the applicant’s claim that there are no AERMs for this component, material, environment combination and noted that NUREG-1883, “Technical Bases for Revision to the License Renewal Guidance Documents,” dated October 2005, Table II.B, item TP-6, indicates that stainless steel exposed to an outdoor air environment could result in loss of material due to pitting and crevice corrosion due to constant wetting and drying conditions. The staff noted that NUREG-1883 recommends the Structures Monitoring Program for managing this component, material, environment, and aging effect combination. Based on its review of this AMR item, the staff determined that additional information was needed regarding the applicant’s claim that there is no AERM for this AMR item. By letter dated November 13, 2009, the staff issued RAI “RAI Stainless Steel” requesting that the applicant provide additional information justifying why stainless steel components exposed to external atmosphere/weather do not have any AERMs.

In its response dated December 14, 2009, the applicant indicated that the components listed in LRA Table 3.4.2-1 are mechanical components, not structural components; therefore, the Structures Monitoring Program is not applicable. The applicant also stated that EPRI TR-1010639, “Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools,” Revision 4, Appendix E, Table 4-1, “Aging Effects Summary – External Surfaces,” concludes that loss of material due to crevice and pitting corrosion are applicable aging mechanisms for stainless steel exposed to outdoor locations (atmosphere and weather) if the following applicability criteria exist: (1) temperature less than 100 °C (212 °F), and (2a) surface is buried or subject to a concentration of contaminants, or (2b) surface is exposed to an aggressive environment in outdoor locations. The applicant indicated that EPRI Mechanical Tools includes the following statement, "Where plant-specific operating experience has shown exposure to aggressive species in outdoor locations, such as salt air in marine areas and sulfur dioxide, acid rain etc. in industrial areas, the normal atmosphere should be considered to be aggressive to exposed metals." The applicant further stated that its outdoor environment does not result in exposure of stainless steel to aggressive species, such as salt air, sulfur dioxide, or acid rain and, therefore, loss of material due to crevice and pitting corrosion is not an applicable aging effect.

Based on its review of the applicant's response to RAI "RAI Stainless Steel," the staff finds the applicant's response acceptable because the outdoor environment at the applicant's location does not result in exposure of stainless steel to an aggressive environment, such as salt air, sulfur dioxide, or acid rain. The staff's concern described in RAI "RAI Stainless Steel" is resolved.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.5 Steel Exposed to Air-Indoor Uncontrolled (External), No Aging Effect, No Aging Management Program

LRA Table 3.4.2-4 summarizes results of AMRs for the main steam isolation and automatic depressurization system.

In LRA Table 3.4.2-4, the applicant stated that for carbon steel valve operators and damper operators in an "air-indoor uncontrolled (external)" environment, there are no AERMs. The applicant also stated that loss of material due to corrosion is not an applicable aging effect due to system temperatures being greater than 212 °F. The applicant referenced Footnote I for this line item indicating that the aging effect in the GALL Report for this component, material, and environment combination is not applicable.

The staff evaluated the applicant's claim that there are no AERMs for this component, material, environment combination and noted that Table 2, item 31 in the GALL Report, Table 2, item 31 indicates that external surfaces of steel components exposed to an indoor uncontrolled air environment are subject to loss of material due to general corrosion. The staff noted that the general corrosion rates due to uncontrolled air exposure tend to increase at higher temperatures. Based on the staff's review of this AMR item, the staff determined that additional information was needed regarding the applicant's claim that there is no AERM for this AMR item. By letter dated November 13, 2009, the staff issued RAI "RAI Steel – Other" requesting that the applicant provide justification why carbon steel valve dampers and damper operators exposed to indoor uncontrolled air do not have aging degradation effects that require an AMP.

In its response dated December 14, 2009, the applicant stated that it had conducted a review of the components in Table 3.4.2-4 and discovered an error. The applicant stated that valve operators do not have temperatures greater than 100 °C (212 °F) and that loss of material due to general corrosion is an applicable aging effect. The applicant revised Table 3.4.2-4 to include the aging effect of loss of material to be managed by the External Surfaces Monitoring

Program for carbon steel valve operators and damper operators in an air-indoor uncontrolled (external) environment. The applicant also revised this line item to reference the GALL Report Table 4, item 28, AMR item VII.H-7 and also changed the footnote from I to A indicating the item is consistent with the GALL Report for component, material, environment, aging effect, and AMP.

Based on its review of the applicant's response to RAI "RAI Steel – Other," the staff finds the applicant's response acceptable because the component, material, environment, aging effect, and AMP are consistent with the GALL Report. The staff's concern described in RAI "RAI Steel – Other" is resolved.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.6 Copper Alloy Valves and Dampers Exposed to Steam

In LRA Table 3.4.2-4 the applicant stated that copper alloy valves and dampers exposed internally to steam are being managed for loss of material by the One-Time Inspection and Water Chemistry Programs. The applicant cited generic note G, indicating that the environment is not in the GALL Report for this component and material.

The staff reviewed all AMR result lines in the GALL Report where the material is copper alloy and the aging effect is loss of material and confirmed that there are no entries for this component and material.

The staff reviewed the applicant's One-Time Inspection and Water Chemistry Programs and its evaluation is documented in SER Sections 3.0.3.1.21 and 3.0.3.1.26, respectively. The staff notes that the applicant's Water Chemistry Program controls certain water chemistry parameters and identifies any actions required if these parameters exceed the plant limits established in accordance with the guidance in EPRI BWRVIP-130, "BWR Water Chemistry Guidelines." The staff also notes that the applicant's One-Time Inspection Program assesses the aging effect of loss of material on susceptible components and is used to verify the effectiveness of the Water Chemistry Program. The staff further notes that the aging effect of loss of material on pressure boundary components exposed to steam is similar to that associated with exposure to treated water, and that the GALL Report recommends use of the "Water Chemistry Program," augmented by the "One-Time Inspection Program" to manage the effects of loss of material for copper alloy components exposed to treated water. The staff also notes that based on material from the Copper Development Institute, copper alloys in general have excellent resistance to corrosion in a steam environment with the only susceptibility being from carbon dioxide, oxygen and ammonia, none of which should be present in any appreciable quantities in the main steam isolation and automatic de-pressurization systems. The staff finds the applicant's currently proposed aging management programs acceptable because the Water Chemistry Program manages the effects of loss of material on copper alloy components by controlling water chemistry parameters that can cause corrosion and the One-Time Inspection Program verifies the effectiveness of the Water Chemistry Program.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL

Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.7 Carbon Steel Fasteners, Bolting, Washers, and Nuts Exposed to Atmosphere/Weather (External)

LRA Table 3.4.2-1 states that carbon steel fasteners, bolting, washers, and nuts exposed to atmosphere/weather (external) are being managed for the loss of preload aging effect by the Bolting Integrity Program. The AMR line item cites generic note G, indicating that for the line item the environment is not in the GALL Report for this component and material.

The staff reviewed all AMR result line items in the GALL Report where the material is carbon steel and the aging effect/mechanism is loss of preload and confirmed that for this environment, there are no entries in the GALL Report for this component and material.

The staff reviewed the applicant’s Bolting Integrity Program and its evaluation is documented in SER Section 3.0.3.1.6. 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 the GALL Report, item VIII.H-5 (S-33), recommends using the Bolting Integrity Program to manage the aging effect of loss of preload in carbon steel bolts exposed to air – indoor uncontrolled. On the basis that the GALL Report recommends the Bolting Integrity program for managing loss of preload in carbon steel bolting exposed to air – indoor uncontrolled and the Bolting Integrity program’s activities for managing loss of preload are applicable for other bolting materials and environments, the staff finds the applicant’s use of the Bolting Integrity program to manage loss of preload in carbon steel bolting exposed to atmosphere/weather to be acceptable.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.8 Steel Piping, Tubing, Turbine and Instrumentation Components Exposed to Air - Indoor Uncontrolled

In LRA Tables 3.4.2-2, 3.4.2-4, 3.4.2-5, the applicant stated that for steel class 1 piping, pipe fittings, tubing, turbine and instrumentation (flow elements, flow orifices) exposed to indoor uncontrolled air where LRA footnote 231 is applicable (i.e., loss of material due to corrosion is not an applicable aging effect due to system temperatures are greater than 212F), there is no aging effect or proposed aging management program. The AMR line item cites generic note I, indicating that the aging effect in the GALL Report for this line item’s component, material and environment combination is not applicable.

The staff reviewed all AMR result line items in the GALL Report where the component and material is steel class 1 piping, pipe fittings, tubing, turbine and instrumentation (flow elements, flow orifices) and confirmed that the component, material environment combination is not applicable.

The staff finds the applicant's proposal acceptable because given that the temperature in the piping systems are above 212F, the uncontrolled indoor air will have the same environmental impact as dried air. The GALL Report, VII.J-22, states that dried air has no aging effect on steel and no AMP is recommended. The staff notes that there will be periods of time during unit shutdowns where the systems will not be at or above 212F. Nevertheless, these periods are short and any accumulated moisture on the external surfaces of the steel is rapidly dried as the systems are started, resulting in minimal aging effects.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM and AMP combinations not addressed in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.9 Carbon Steel Pipe, Pipe Fittings, Hoses, Tubes, and Rupture Disks Exposed to Treated Water (Internal)

In LRA Table 3.4.2-2 the applicant stated the carbon steel piping, pipe fittings, hoses, tubes, rupture disks, and valves exposed to treated water are being managed for loss of material by the Flow-Accelerated Corrosion Program. The AMR line item cites generic note H, indicating that for the line item, the aging effect is not in the GALL Report for this component, material, and environment combination. The applicant also cited plant-specific note 222 for the associated line item, which stated that erosion had occurred on some components, as described in the plant operating experience database, and that the loss of material due to erosion for these components is managed by the Flow-Accelerated Corrosion Program.

The staff reviewed all AMR result line items in the GALL Report where the component and material is carbon steel piping, pipe fittings, hoses, tubes, and rupture disks exposed to treated water and confirmed that there are no aging effect entries in the GALL Report for this component, material, and environment combination.

The staff reviewed the applicant's Flow-Accelerated Corrosion Program and its evaluation is documented in SER Section 3.0.3.1.17. The staff finds the applicant's currently proposed AMP acceptable because, as clarified in its follow-up response to RAI B3.24-1 dated February 2, 2010, the applicant provided details on their Flow-Accelerated Corrosion Program including stating that the program includes inspection of locations susceptible to erosion based on operating experience, uses the same techniques as those used for measuring wall thinning due to flow-accelerated corrosion, trends inspection results, and initiates corrective actions prior to loss of intended function. This AMP is capable of detecting and managing the loss of material due to erosion in carbon steel pipe and components exposed to treated water.

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).

3.4.2.3.10 Aluminum Piping and Instrumentation Elements Exposed to Lubricating oil (internal)

In LRA Table 3.4.2-5 the applicant stated that the aluminum alloy instrumentation and instrumentation components and elements exposed to lubricating oil (internal) are being managed for loss of material by the Lubricating Oil Analysis Program and its effectiveness is evaluated through the One-Time Inspection Program. The AMR line items cite generic note F, indicating that for the line items the material is not in the GALL Report for this component. The applicant also cited plant specific note 207 for each of the associated line items, which stated that “Material/environment combination and/or aging effect/mechanism is not identified in NUREG-1801. The aging management program(s) referenced are appropriate for the aging effects/mechanisms identified and provide assurance that the aging effects/mechanisms are effectively managed through the period of extended operation.”

The staff reviewed all AMR result line items in the GALL Report where the environment is lubricating oil (internal) and the aging effect or mechanism is loss of material, cracking, and reduction of heat transfer due to detrimental contaminants in the lubricating oil and confirmed that there are no entries for this component and material.

In LRA Table 3.3.2-29, the applicant stated that the aluminum alloy instrumentation and instrumentation components and elements exposed to lubricating oil (internal) are being managed for loss of material by the Lubricating Oil Analysis Program and its effectiveness evaluated through the One-Time Inspection Program. The AMR line items cite the generic note J, indicating that for this line item, neither the component nor the material and environment combination is evaluated in the GALL Report. The applicant also cited, for each of the associated line items, plant specific note 202, which stated that, “Aging mechanism is in addition to aging mechanisms in NUREG-1801. This may include galvanic corrosion, MIC, wear and/or selective leaching,” and plant specific note 223, which stated that, “The component and material are different, but consistent with NUREG-1801 for environment and aging effect. The aging management program referenced is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects are effectively managed through the period of extended operation.”

The staff reviewed all AMR result line items in the GALL Report where the component and material is aluminum alloy and instrumentation and/or instrumentation component and element and confirmed that there are no entries for this component and material where the aging effect and mechanism is loss of material due to cracking, and reduction of heat transfer due to detrimental contaminants in the lubricating oil.

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).

3.4.2.3.11 Copper Heat Exchangers and Heat Exchanger Components and Elements Exposed to Lubricating Oil (external)

In LRA Table 3.3.2-6 the applicant stated that the copper heat exchangers and heat exchanger components and elements exposed to lubricating oil (external) are being managed for loss of material by the Lubricating Oil Analysis Program and its effectiveness evaluated through the One-Time Inspection Program. The AMR line items cite generic note I, indicating that the aging effect in the GALL Report for these line item components, material and environment combination is not applicable. The applicant also cited plant specific note 225 for each of the associated line items, which stated that “Crevice and pitting corrosion are not applicable aging mechanisms for copper alloy components with less than 15% zinc and aluminum bronze components with less than 8% aluminum in fuel oil and lube oil environments at Duane Arnold."

The staff reviewed all AMR result line items in the GALL Report where the component and material is copper and heat exchanger and heat exchanger components and elements, and confirmed that this component, material and environment combination is not applicable, if the referenced note extends to pure copper material. If, however, copper alloy components with less than 15% zinc are used, then this combination of material component and environment is consistent with the GALL Report and no further evaluation is required.

The staff reviewed the applicant's Lubricating Oil Analysis and One-Time Inspection Programs and its evaluation is documented in SER Sections 3.0.3.2.8 and 3.0.3.1.21. The GALL Report, Section IX.C, states that aluminum alloy components with low aluminum concentrations and copper alloy components with low zinc concentrations are resistant to stress corrosion cracking, selective leaching and pitting and crevice corrosion. The staff notes that the GALL Report recommends use of GALL AMP XI.M39, "Lubricating Oil Analysis Program" augmented by GALL AMP XI.M32, "One-Time Inspection Program" to manage the effects of loss of material for copper alloy components exposed to lubricating oil. The staff also notes that the Lubricating Oil Analysis Program includes analysis and trending of oil samples to monitor for contaminants in the lubricating oil, including water and particulates, to ensure they remain within acceptable limits and that the applicant's One-Time Inspection Program is used to verify the effectiveness of the Lubricating Oil Analysis Program.

The staff finds the applicant's proposal acceptable because: (1) copper and aluminum alloy components exposed to lubricating oil environments do not experience appreciable degradation by loss of material since the environment is not conducive to corrosion mechanisms and aluminum alloy is inherently resistant to pitting and crevice corrosion; (2) the Lubricating Oil Analysis Program monitors the lubricating oil for contaminants; and (3) visual inspections will be used to verify the effectiveness of the Lubricating Oil Analysis Program.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not addressed in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the steam and power conversion systems components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5 Aging Management of Structures and Structural Components

This section of the SER documents the staff's review of the applicant's AMR results for the structures and structural components of:

- buildings, structures affecting safety
- control building
- cranes and hoists
- intake structure
- miscellaneous yard structures
- offgass stack
- primary containment structure
- pump house
- reactor building
- supports
- turbine building

3.5.1 Summary of Technical Information in the Application

LRA Section 3.5 provides AMR results for the structures and structural components. LRA Table 3.5-1, "Summary of Aging Management Evaluations in Chapters II and III of NUREG-1801 Structures and structural components," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the structures and structural components groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.5.2 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 structural components within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff conducted an onsite audit of 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 3.5.2.1.

In the onsite audit, the staff also selected AMRs consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the SRP-LR Section 3.5.2.2 acceptance criteria. The staff's audit evaluations are documented in SER Section 3.5.2.2.

The staff also conducted a technical review of the remaining AMRs not consistent with or not addressed in the GALL Report. The technical review evaluated whether all plausible aging effects have been identified and whether the aging effects listed were appropriate for the material-environment combinations specified. The staff's evaluations are documented in SER Section 3.5.2.3.

For SSCs which the applicant claimed were not applicable or required no aging management, the staff reviewed the AMR line items and the plant's operating experience to verify the applicant's claims.

The staff's review of the structures and structural components groups followed any one of several approaches. One approach, documented in SER Section 3.5.2.1, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.5.2.2, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.5.2.3, reviewed AMR results for components that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the structures and structural components is documented in SER Section 3.0.3.

3.5.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.5.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the structures and structural components:

- 10 CFR Part 50, Appendix J Program
- ASME Section XI, Subsection IWE Program
- ASME Section XI, Subsection IWF Program
- Boral Surveillance Program
- Buried Piping and Tanks Inspection Program
- Fire Protection Program
- Overhead Handling Systems Program
- Structures Monitoring Program
- Water Chemistry Program

LRA Tables 3.5.2-1 through 3.5.2-11 summarize AMRs for the structures and structural components group and indicate AMRs claimed to be consistent with the GALL Report.

For component groups evaluated in the GALL Report for which the applicant claimed consistency with the report and for which it does not recommend further evaluation, the staff's audit and review determined whether the plant-specific components of these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant noted for each AMR line item how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with notes A through E indicating how the AMR is consistent with the GALL Report.

Note A indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report and validity of the AMR for the site-specific conditions.

Note B indicates that the AMR line item is consistent with the GALL Report for component, material, environment, and aging effect. In addition, the AMP takes some exceptions to the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report and verified that the identified exceptions to the GALL Report AMPs have been reviewed and accepted. The staff also determined whether the applicant's AMP was consistent with the GALL Report AMP and whether the AMR was valid for the site-specific conditions.

Note C indicates that the component for the AMR line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP is consistent with the GALL Report AMP. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report; however, the applicant identified in the GALL Report a different component with the same material, environment, aging effect, and AMP as the component under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicates that the component for the AMR line item, although different from, is consistent with the GALL Report for material, environment, and aging effect. In addition, the AMP takes some exceptions to the GALL Report AMP. The staff audited these line items to verify consistency with the GALL Report. The staff confirmed whether the AMR line item of the different component was applicable to the component under review and whether the identified exceptions to the GALL Report AMPs have been reviewed and accepted. The staff also determined whether the applicant's AMP was consistent with the GALL Report AMP and whether the AMR was valid for the site-specific conditions.

Note E indicates that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but credits a different AMP. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the credited AMP would manage the aging effect consistently with the GALL Report AMP and whether the AMR was valid for the site-specific conditions.

The staff audited and reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the containments, structures, and components supports components that are subject to an AMR. On the basis of its audit and review, the staff determines that, for AMRs not requiring further evaluation, as identified in LRA Table 3.5.1, the applicant's references to the GALL Report are acceptable and no further staff review is required, with the exception of the following AMRs that the applicant 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 subsection that follows.

3.5.2.1.1 AMR Results Identified as Not Applicable

In LRA Table 3.5.1, items 1, 7, 14, 15, and 22, the applicant stated that the corresponding AMR items in the GALL Report are not applicable because DAEC is a BWR reactor design that incorporates a Mark I free-standing steel containment located in a reactor building and the AMR items in the GALL Report are only applicable to particular components of BWR designs that use a concrete containment. The staff confirmed that the stated AMR items in the GALL Report are only applicable to concrete containments and are not applicable to the LRA.

3.5.2.1.2 Loss of Leak Tightness in Closed Position Due to Mechanical Wear of Locks, Hinges, and Closure Mechanisms

In LRA Tables 3.5.2-1 through 3.5.2-11, for line items that reference Table 3.5-1, item 3.5.1-17 and note E, the applicant credits the Structures Monitoring Program for managing loss of leak tightness in an air-indoor uncontrolled environment for carbon steel doors.

The staff reviewed the AMR items discussed above and determined that the material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, the GALL line item component discusses containment hatches and the GALL Report recommends GALL AMP XI.S4, "10 CFR Part 50, Appendix J." The applicant has proposed using the Structures Monitoring Program (SER Section 3.0.3.2.11) to manage a carbon steel door with an intended function of control room habitability. The staff reviewed this AMR and finds it acceptable because the 10 CFR Part 50 Appendix J Program is performed to determine the leak rates of the containment and containment components. The Structures Monitoring Program is an appropriate AMP for structures that are not part of containment. Periodic visual inspections under the Structures Monitoring Program will adequately detect degradation of the managed component during the period of extended operation; therefore, the staff finds these AMR results to be acceptable.

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).

The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing aging effects. On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are indeed consistent with its AMRs. Therefore, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.1.3 Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling) Due to Corrosion of Embedded Steel

In LRA Tables 3.5.2-1 through 3.5.2-11, for line items that reference Table 3.5-1, item 3.5.1-23 or Table 3.3-1, item 3.3.1-65, and note E, the applicant credits the Fire Protection Program for managing the aging effect/mechanism in an air-indoor uncontrolled or air-outdoor environment. The applicant also included plant-specific note 511 that states, “Grout is part of the masonry wall construction, used as fill/bond for reinforcing steel in block walls.”

The staff reviewed the AMR results discussed above and determined, for these items, 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 GALL AMP XI.S6, “Structures Monitoring Program,” the applicant has proposed to use the Fire Protection Program. In the LRA, the applicant stated that intended functions related to this line item include shelter, protection, and structural support as well as fire barrier. In the Structures Monitoring Program basis documents, reviewed during the onsite audit, the applicant stated that all fire barriers, including doors, walls and floor, and masonry walls are examined using the Structures Monitoring Program as the primary AMP; however, these components are also examined under the Fire Protection Program to provide an added degree of assurance that age-related degradation is detected in a timely manner and that openings and damage that could impact fire rating are detected.

Since the applicant uses the GALL Report recommended Structures Monitoring Program as the primary AMP, the staff finds the applicant’s additional use of the Fire Protection Program acceptable. The staff’s review of the Structures Monitoring Program and Fire Protection Program are documented in SER Sections 3.0.3.2.11 and 3.0.3.2.4, respectively. Since the applicant has committed to use the appropriate AMP for the period of extended operation, the staff finds these AMR results to be acceptable.

In LRA Tables 3.5.2-1 through 3.5.2-11, for line items that reference Table 3.5-1, item 3.5.1-34, and note E, the applicant credits the Structures Monitoring Program for managing the aging effects/mechanisms in an external environment for concrete having intended functions of shelter, protection, structural support, and structure. The applicant also included plant-specific note 508 for concrete component type which states that, “Cracking, loss of bond, and loss of material (scaling, spalling)/corrosion of embedded steel is not listed in GALL III.A6-1 as an aging effect for concrete in raw water. Duane Arnold manages this effect with the Structures Monitoring Program.”

The staff reviewed the AMR results discussed above and determined that the component type, material, and aging effects are consistent with the corresponding line of the GALL Report; however, the GALL Report recommends GALL AMP XI.S7, “RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program,” and identifies the environment as air-indoor uncontrolled or air-outdoor for these aging effects. The staff noted that inspections related to this LRA line item are performed under an existing program included in the Structures Monitoring Program that is consistent with GALL AMP XI.S7. The staff’s review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.11. Since the Structures Monitoring Program includes and is consistent with GALL AMP XI.S7, the staff finds these AMR results to be acceptable.

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).

3.5.2.1.4 Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling) Due to Aggressive Chemical Attack

In LRA Tables 3.5.2-1 through 3.5.2-11, for line items that reference Table 3.5-1, item 3.5.1-24, and note E, the applicant credits the Fire Protection Program for managing this aging effect/mechanism in an air-indoor uncontrolled (external) or atmosphere/weather (external) environment. The applicant also included plant-specific note 511 for the grout component type that states, “Grout is part of the masonry wall construction, used as fill/bond for reinforcing steel in block walls.”

The staff reviewed the AMR results discussed above and determined, for these items, 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 GALL AMP XI.S6, “Structures Monitoring Program,” the applicant has proposed using the Fire Protection Program. In the LRA, the applicant stated that component types include concrete and grout with intended functions of fire barrier, missile barrier, shelter, shielding, protection, structure, and structural support. In the Structures Monitoring Program basis documents, reviewed during the onsite audit, the applicant stated that all fire barriers, including doors, walls and floor, and masonry walls are examined using the Structures Monitoring Program as the primary AMP; however, these components are also examined under the Fire Protection Program to provide an added degree of assurance that age-related degradation is detected in a timely manner and that openings and damage that could impact fire rating are detected. Since the applicant stated that it uses the GALL Report recommended Structures Monitoring Program as the primary AMP, the staff finds the applicant’s additional use of the Fire Protection Program acceptable. The staff’s review of the Structures Monitoring Program and Fire Protection Program are documented in SER Sections 3.0.3.2.11 and 3.0.3.2.4, respectively. Since the applicant has committed to an appropriate AMP for the period of extended operation, the staff finds these AMR results to be acceptable.

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).

3.5.2.1.5 Loss of Material (Spalling, Scaling) and Cracking Due to Freeze-Thaw

In LRA Tables 3.5.2-1 through 3.5.2-11, for line items that reference Table 3.5-1, item 3.5.1-35, and note E, the applicant credits the Structures Monitoring Program for managing loss of material due to freeze-thaw in an atmosphere weather (external) environment for concrete having intended functions of missile barrier, shelter, protection, structural support, and structure.

The staff reviewed the AMR results discussed above and determined that the component type, material, environment, and aging effects are consistent with the corresponding line of the GALL Report; however, the GALL Report recommends GALL AMP XI.S7, “RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program.” The staff noted that inspections related to this LRA line item are performed under an existing program included in the Structures Monitoring Program that is consistent with GALL AMP XI.S7. The staff’s review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.11. Since the

Structures Monitoring Program includes the aging management of water-control structures, that is consistent with GALL AMP XI.S7, the staff finds these AMR results to be acceptable.

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).

3.5.2.1.6 Cracking Due to Expansion/Reaction with Aggregates

In LRA Tables 3.5.2-1 through 3.5.2-11, for line items that reference Table 3.5-1, item 3.5.1-36, and note E, the applicant credits the Structures Monitoring Program for managing cracking due to expansion/reaction with aggregates in a raw water or external weather environment for concrete having intended functions of shelter, protection, structural support, and structure.

The staff reviewed the AMR results discussed above and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, the GALL Report recommends GALL AMP XI.S7, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program." The staff noted that inspections related to this LRA line item are performed under an existing program included in the Structures Monitoring Program that is consistent with GALL AMP XI.S7. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.11. Since the Structures Monitoring Program includes the aging management of water-control structures, that is consistent with GALL AMP XI.S7, the staff finds these AMR results to be acceptable.

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).

3.5.2.1.7 Increase in Porosity and Permeability, Loss of Strength Due to Leaching of Calcium Hydroxide

In LRA Tables 3.5.2-1 through 3.5.2-11, for line items that reference Table 3.5-1, item 3.5.1-37, and note E, the applicant credits the Structures Monitoring Program for managing increase in porosity and permeability and loss of strength in raw water (external) environment for concrete having intended functions of shelter, protection, and structural support.

The staff reviewed the AMR results discussed above and determined that the component type, material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, the GALL Report recommends GALL AMP XI.S7, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program." The staff noted that inspections related to this LRA line item are performed under an existing program included in the Structures Monitoring Program that is consistent with GALL AMP XI.S7. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.11. Since the Structures Monitoring Program includes the aging management of water-control structures, that is consistent with GALL AMP XI.S7, the staff finds these AMR results to be acceptable.

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).

3.5.2.1.8 Cracking Due to Restraint Shrinkage, Creep, and Aggressive Environment

In LRA Tables 3.5.2-1 through 3.5.2-11, for line items that reference Table 3.5-1, item 3.5.1-43, and note E, the applicant credits the Structures Monitoring or Fire Protection programs for managing cracking due to restraint shrinkage, creep and an aggressive environment of concrete in an air-indoor uncontrolled or weather environment.

The staff reviewed the AMR results discussed above and determined, for these items, that the component type, material, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends GALL AMP XI.S5, "Masonry Wall Program," the applicant has proposed using the Structures Monitoring and Fire Protection Program. The applicant stated in the LRA, and the staff confirmed in the program basis documents that the Structures Monitoring Program includes and is consistent with GALL AMP XI.S5. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.11. The applicant also identified the Fire Protection Program to manage cracking. However, the staff was unable to confirm that the appropriate inspection frequency and acceptance criteria are being used if the Fire Protection Program is used in lieu of the Structures Monitoring Program. Therefore, by letter dated November 13, 2009, the staff asked the applicant to: (1) resolve the discrepancy between LRA Tables 3.5.1 and 3.5.2-8 and confirm if the Fire Protection Program should have been included in Table 3.5.1, item 3.5.1-43 discussion column; (2) confirm, if the Fire Protection Program is used in lieu of GALL AMP XI.S5, that an inspection frequency of once every RFO as recommended by GALL AMP XI.M26, "Fire Protection Program," is maintained for visual inspection of concrete masonry units since GALL AMP XI.S5 does not recommend a specific frequency; (3) provide information on what acceptance criteria will be used if the Fire Protection Program is credited to manage cracking of concrete masonry units since the acceptance criteria of GALL AMP XI.S5 are different from the acceptance criteria of the Fire Protection Program, and the Fire Protection Program has not been enhanced to include acceptance criteria of GALL AMP XI.S5 that includes observing degradation of steel edge supports and bracing so as not to invalidate the evaluation basis; and (4) confirm that if the Fire Protection Program qualified inspectors are used to perform visual inspections of the masonry walls, the inspectors are also qualified to perform visual inspections of concrete masonry walls.

By letter dated December 14, 2009, the applicant provided the following responses:

(1) The Fire Protection Program should have been listed in the Table 3.5.1, item 3.5.1-43 discussion. Accordingly, in LRA Table 3.5.1, item 3.5.1-43 on page 3.5-37, the discussion entry is revised to read, "This program is consistent with NUREG-1801. The Structures Monitoring Program, which includes Masonry Walls, will confirm the absence of AERMs. The Fire Protection Program will perform its own fire barrier visual inspection by a qualified fire protection inspector to examine for any signs of degradation such as cracking."

(2) The Fire Protection Program will perform visual inspection for cracking on fire barrier walls, ceilings, and floors (concrete masonry fire barrier walls are treated as concrete fire barrier walls) with a qualified fire protection inspector at a frequency prescribed by the Fire Protection Program. As discussed in the response to RAI B.3.22-5 provided in letter NG-09-0764 dated October 13, 2009, the DAEC Fire Barrier Penetration Seal

Inspection surveillance performs a visual inspection of 35 percent of fire barrier walls, ceilings, and floors on an 18-month frequency, with 100 percent of fire barrier walls, ceilings, and floors inspected each 5 years.

(3) As discussed above in (2), the Fire Protection Program will provide its own visual inspection of fire barrier walls, ceilings, and floors by a qualified inspector to examine for any sign of degradation such as cracking, spalling, and loss of material caused by freeze-thaw, chemical attack, and reaction with aggregates. As discussed in LRA Section B.3.37, Structures Monitoring Program, GALL AMP XI.S5, “Masonry Wall Program” has been combined with GALL AMP XI.S6, “Structures Monitoring Program.” Inspections of masonry walls are performed in conjunction with, and at the same frequency as, the Structures Monitoring Program inspections. Acceptance criteria are specified in the Structures Monitoring Program.

(4) Qualified fire protection inspectors will inspect concrete and masonry walls that are used as fire barriers. As discussed in response to RAI B.3.22-1 provided in letter NG-09-0764 dated October 13, 2009, the Fire Barrier Penetration Seal Inspection surveillance procedure will be enhanced to include criteria for visual inspection by a qualified fire protection inspector for cracking on fire barrier walls, ceilings, and floors (masonry fire barrier walls are treated as concrete fire barrier walls).

The staff reviewed the applicant’s response and found it acceptable because it explains that the AMR items which reference GALL Report item 3.5.1-43 will be managed by the GALL Report recommended Structures Monitoring Program, while the Fire Protection Program will conduct additional inspections in accordance with the requirements of the Fire Protection Program (SER Section 3.0.3.2.4).

Since the applicant has committed to the appropriate GALL Report recommended AMPs for the period of extended operation, the staff finds the responses acceptable and finds the applicant has appropriately addressed the aging effect or mechanism.

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).

3.5.2.1.9 Loss of Material Due to Abrasion and Cavitation

In LRA Tables 3.5.2-1 through 3.5.2-11, for line items that reference Table 3.5-1, item 3.5.1-45, and note E, the applicant credits the Structures Monitoring Program for managing loss of material due to abrasion and cavitation resulting from raw water (external or internal) environment.

The staff reviewed the AMR results discussed above and determined, for these items, that the component type, material, and aging effect are consistent with the corresponding line of the GALL Report; however, where the GALL Report recommends GALL AMP XI.S7, “Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants,” as the AMP, the applicant has proposed using the Structures Monitoring Program. The applicant stated in the LRA and the staff confirmed in the program basis documents that the Structures Monitoring Program includes and is consistent with GALL AMP XI.S7. The staff’s review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.11. Since the Structures

Monitoring Program includes the recommendations of GALL AMP XI.S7; requires visual inspections on a periodic basis to manage loss of material due to abrasion/cavitation; and uses guidance in ACI 349.3R-96; the staff finds the applicant's use of the Structures Monitoring Program acceptable. Since the applicant has committed to an appropriate AMP for the period of extended operation, the staff finds these AMR results to be acceptable.

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).

3.5.2.1.10 Loss of Mechanical Function Due to Corrosion, Distortion, Dirt, Overload, Fatigue Due to Vibratory and Cyclic Thermal Loads

In LRA Tables 3.5.2-1 through 3.5.2-11, for line items that reference Table 3.5-1, item 3.5.1-54 and note E, the applicant credits the Structures Monitoring Program for managing loss of mechanical function in an air-indoor uncontrolled environment for non-ASME constant and variable load spring hangers, guides, and stops.

The staff reviewed the AMR items discussed above and determined that the material, environment, and aging effect are consistent with the corresponding line of the GALL Report; however, the GALL line item component discusses Class 1 ASME supports and the GALL Report recommends GALL AMP XI.S3, "ASME Section XI, Subsection IWF." The applicant has proposed using the Structures Monitoring Program (SER Section 3.0.3.2.11) for non-ASME supports. The staff reviewed this AMR and finds it acceptable because the ASME Section XI Inservice Inspection, IWF Program is intended to inspect ASME supports, while the Structures Monitoring Program inspects Group B2 supports (i.e., non-ASME piping and component supports). This logic is supported by the guidance in GALL Report Chapters III.B2 – III.B5, which discuss non-ASME supports and recommend the Structures Monitoring Program to manage similar aging effects. Since the applicant has committed to an appropriate GALL Report recommended AMP (i.e. the Structures Monitoring Program for non-ASME supports) for the period of extended operation, the staff finds these AMR results to be acceptable.

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).

3.5.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.5.2.2, the applicant further evaluates aging management, as recommended by the GALL Report, for the containments, structures, and components supports components and provides information concerning how it will manage aging effects in the following three areas:

(1) BWR containment:

- aging of inaccessible concrete areas

- cracks and distortion due to increased stress levels from settlement; reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations if not covered by the Structures Monitoring Program
- reduction of strength and modulus of concrete structures due to elevated temperature
- loss of material due to general, pitting, and crevice corrosion
- loss of prestress due to relaxation, shrinkage, creep, and elevated temperature
- cumulative fatigue damage
- cracking due to SCC
- cracking due to cyclic loading
- loss of material (scaling, cracking, and spalling) due to freeze-thaw
- cracking due to expansion and reaction with aggregate and increase in porosity and permeability due to leaching of calcium hydroxide

(2) safety-related and other structures and component supports:

- aging of structures not covered by the Structures Monitoring Program
- aging management of inaccessible areas
- reduction of strength and modulus of concrete structures due to elevated temperature
- aging management of inaccessible areas for Group 6 structures
- cracking due to SCC and loss of material due to pitting and crevice corrosion
- aging of supports not covered by the Structures Monitoring Program
- cumulative fatigue damage due to cyclic loading

(3) QA for aging management of nonsafety-related components

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which the report recommends further evaluation, the staff audited and reviewed the applicant’s evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant’s further evaluations against the criteria contained in SRP-LR Section 3.5.2.2.The staff’s review of the applicant’s further evaluation follows.

3.5.2.2.1 BWR Containment

The staff reviewed LRA Section 3.5.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.1, which address several areas:

Aging of Inaccessible Concrete Areas. In LRA Section 3.5.2.2.1.1, the applicant stated that DAEC has a Mark I free-standing steel containment located in the reactor building. In LRA Table 3.5.2-7, the applicant stated that the containment concrete is used only to meet intended functions of shielding and structural support and that aging of the containment concrete is managed by the Structures Monitoring Program for cracking, loss of bond, loss of material (e.g., spalling or scaling), expansion and cracking, and increase in porosity and permeability. The applicant stated concrete was constructed in accordance with recommendations in ACI 201.2R-77 for durability and that the aggregate materials were tested to confirm that they were sound and not reactive. The applicant also stated that these aging effects do not require aging management for the period of extended operation.

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 (eg., spalling or scaling) due to aggressive chemical attack, and cracking, loss of bond, and loss of material (eg., spalling or scaling) due to corrosion of embedded steel could occur in inaccessible areas of PWR and BWR concrete and steel containments. The GALL report identifies ASME Section XI, Subsection IWL to manage these aging effects and recommends further evaluation of plant-specific programs to manage these aging effects for inaccessible areas if the environment is aggressive.

The staff reviewed the UFSAR and confirmed that no containment-related concrete serves a pressure-retaining function and is, therefore, not subject to ASME Section XI, Subsection IWL inspections or further evaluation. Aging of the containment-related concrete is managed by the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.11. SER Section 3.5.2.2.2, 'Aging Management of Inaccessible Areas,' documents the staff's review of the applicant's evaluation of aging management of inaccessible areas, including the containment-related concrete. The staff finds that the inaccessible concrete does not need to be evaluated in this section because it does not serve a containment pressure retaining function.

Cracks and Distortion Due to Increased Stress Levels from Settlement; Reduction of Foundation Strength, Cracking, and Differential Settlement Due to Erosion of Porous Concrete Subfoundations, If Not Covered by the Structures Monitoring Program. In LRA Section 3.5.2.2.1.2, the applicant stated that DAEC has a Mark I free-standing steel containment located in the reactor building. In LRA Table 3.5.2-7, the applicant stated that the containment concrete is used only to meet intended functions of shielding and structural support. The applicant stated that seismic Category 1 structures are located on top of limestone bedrock or soil; general differential settlement in all Seismic Category I buildings is detected through Maintenance Rule inspections to identify cracking on concrete surfaces near areas of stress concentration; and that neither porous concrete foundations nor calcium aluminate cement were used at DAEC. The applicant also stated that these aging effects do not require management for the period of extended operation.

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; and reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations could occur. The GALL Report identifies the Structures Monitoring Program to manage these aging effects and no further evaluation is recommended if this activity is within the scope of the Structures Monitoring Program.

The staff reviewed the UFSAR and confirmed that: (1) the containment-related concrete only provides structural support and shielding functions, (2) settlement of concrete is managed by the Structures Monitoring Program, and (3) that a porous concrete foundation does not exist at DAEC. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.11. The staff finds that the containment concrete does not need to be evaluated for cracks and distortion due to settlement or erosion of porous concrete subfoundation in this section because it does not serve a containment pressure retaining function.

Reduction of Strength and Modulus of Concrete Structures Due to Elevated Temperature. In LRA Section 3.5.2.2.1.3, the applicant stated that the drywell cooling system maintains the drywell ambient air temperatures to less than 66 °C (150 °F) and there are no local area temperatures greater than 93 °C (200 °F). The highest general area normal maximum operating temperature is at the main steam pipe chase and inside drywell. The applicant further stated that the main steam pipe chase and drywell general area normal maximum operating temperature is 57 °C (135 °F), or less. The applicant also stated that elevated air temperatures in the drywell are not an issue for containment concrete, therefore, reduction in strength and modulus of containment concrete structures due to elevated temperatures for any portion of concrete containment-related components is not an aging effect requiring management for the period of extended operation.

The staff reviewed LRA Section 3.5.2.2.1.3 against the criteria in SRP-LR Section 3.5.2.2.1.3, which recommends further evaluation of the plant-specific AMP if any portion of the concrete containment components exceeds the specified temperature limits of 66 °C (150 °F) general and 93 °C (200 °F) local.

The staff reviewed the applicant's UFSAR and confirmed that no in-scope concrete is exposed to temperatures beyond the GALL Report suggested limits and, therefore, finds acceptable the applicant's determination that this aging effect is not applicable.

Loss of Material Due to General, Pitting and Crevice Corrosion. The staff reviewed LRA Section 3.5.2.2.1.4 against the criteria in SRP-LR Section 3.5.2.2.1.4.

In LRA Section 3.5.2.2.1.4 the applicant addresses loss of material due to general, pitting and crevice corrosion for steel elements of accessible and inaccessible areas of containments. The applicant stated that: (1) the primary containment is a steel, Mark I containment system employing a drywell and a separate pressure suppression chamber, (2) the drywell is surrounded by a reinforced concrete structure (bioshield) and separated from the concrete by an air gap, (3) the base of the drywell is supported on reinforced concrete, and (4) there is a sand (cushion) pocket at the transition from concrete to the air gap. The applicant further stated that the concrete in contact with the drywell shell was constructed in accordance with the recommendations in American Concrete Institute (ACI) 201.2R-77, and the concrete is monitored for cracks under the Structures Monitoring Program. The drywell shell and the moisture barrier where the drywell shell is embedded in the drywell concrete floor are inspected in accordance with the ASME Section XI Subsection IWE Program, and the sand pocket is drained to protect the exterior surface of the drywell shell at the sand pocket interface from water that might enter the gap. In LRA Table 3.5.2-7, the applicant stated that the ASME

Section XI Subsection IWE Program and the 10 CFR 50, Appendix J Program are the AMPs used to manage loss of material for the primary containment structure.

In the LRA, the applicant also stated that in order to address LR-ISG-2006-01, "Corrosion of the Mark I Steel Containment Drywell Shell," the following was provided (item numbers correspond to item numbers for recommendations in the ISG):

(1) Ultrasonic testing measurements conducted in 1990 (DAEC started operating in 1974) indicated that no measurable corrosion has occurred. The applicant notes that drywell shell ultrasonic wall thickness measurements were taken in 1990 because of corrosion concerns due to CRD piping leaks in the drywell air gap area. Concrete was removed at the concrete-to-shell interface inside the drywell for ultrasonic measurements at 95° and 185° azimuths. The locations are at the exterior sand pocket region. The results of the drywell shell thickness measurements ranged from 1.56 inches to 1.63 inches, out of more than 200 ultrasonic readings, indicating that the drywell shell thickness has adequate corrosion allowance margin. Minimum shell and liner thickness calculations show that in the sand pocket area, the thickness required, for the most conservative loading combination, is less than 1 inch, and the nominal plate design thickness is 1.5 inches or more; therefore, inferring a corrosion allowance of about 0.5 inches. Since no loss in thickness has been identified, the corrosion rate is indeterminate.

(2) Ultrasonic measurements performed in 1990 have concluded that no measurable corrosion has occurred, therefore, no corrosion rate can be established.

(3) No measurable degradation has been identified in the accessible or inaccessible areas of the drywell. Therefore, an evaluation that addresses the conditions for similar conditions is not applicable for DAEC.

(4) Moisture levels associated with accelerated corrosion rates do not exist in the exterior portion of the drywell shell. The sand pocket at the transition from the air gap to the drywell support concrete is sealed with a galvanized steel plate. Any leakage of water into the air gap between the drywell and surrounding concrete shield wall above the sheet metal plate would be directed to the torus room basement via four drain lines. If water penetrates the sheet metal or seal and enters the sand pocket, four additional sand-filled drain lines would drain the sand pocket to the torus room basement.

    The design of the drywell to reactor building refueling bellows prevents leakage of water into the drywell air gap. Four bellows area drain lines are seal welded to a steel plate below the refueling bellows. Any leakage past the bellows area will be directed through drain lines. A lip between the air gap and the drain lines prevents bellows leakage from entering the drywell air gap. Drainage from this area is directed to the Rad Waste System. Any leakage greater than 0.1 gpm, will trigger an alarm which will initiate operator action to determine and correct the cause of excessive leakage.

    The area in the torus room basement where the air gap drain lines and the sand-filled drain lines drain are inspected periodically.

(5) No moisture/leakage has been found due to refueling bellows or fuel pool leakage. Inspections of the sand pocket drain lines in response to GL 87-05, "Request for Additional Information Assessment of Licensee Measures To Mitigate and/or Identify Potential Degradation of Mark I Drywell," have indicated that no moisture or leakage was present in the sand pocket area, after inspection of the air gap drain lines and the sand-filled drains lines.

Moisture had been detected in the inaccessible area on the exterior of the drywell shell in August 1985 in the Torus Room near downcomer/vent line penetration X-05C. Leakage rate was estimated at ~1 gallon per hour (gph). In May 1990, a pinhole leak near the toe of a CRD insert/withdraw line fillet weld to the drywell shell was found to be the source of moisture. Subsequent investigations found flaws in the southwest CRD penetration bundle. Ultrasonic testing of drywell shell in the affected area did not indicate any loss of thickness due to corrosion. In addition, no leakage was identified at the other three CRD penetration bundles. Repairs were satisfactorily made to the southwest CRD bundle in 1990, and no recurrence of CRD line leakage has been identified.

No leakage since 1990 has been experienced or identified.

(6) No further actions are required since the drywell shell has not exhibited any loss of material that could result in loss of its intended function over the period of extended operation.

The applicant stated that it will continue to implement current inspections and observations to ensure that any leakage is detected and corrective action is taken. Since there has not been any measurable corrosion and the drywell shell has not exhibited any leakage in the sand pocket area, significant corrosion of the drywell shell is not expected, and no additional AMP is required for the period of extended operation.

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. The existing program relies on ASME Section XI Subsection IWE, and 10 CFR Part 50, Appendix J to manage this aging effect. The GALL Report recommends further evaluation of plant-specific programs to mange this aging effect for inaccessible areas if corrosion is significant. GALL Report Item II.B1.1-2 states that for inaccessible areas (eg., 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 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 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

The staff reviewed the UFSAR and found that all concrete work was in accordance with ACI 318-63. Additional ASTM and ACI standards were followed during construction to ensure that the concrete was constructed in accordance with recommended guidance in ACI 201.2R-77.

Further discussion of the acceptability of the concrete is documented in SER Section 3.5.2.2.2.2. The staff confirmed that the concrete is monitored for cracks under the Structures Monitoring Program, and that the moisture barrier at the junction where the shell or liner becomes embedded is inspected in accordance with the ASME Section XI, Subsection IWE requirements. In the LRA, the applicant also stated that it uses the ASME Section XI Subsection IWE Program and the 10 CFR 50, Appendix J Program as AMPs to manage loss of material for the primary containment structure, and that no measurable corrosion has occurred in the drywell shell, and that shell thickness calculations for the sand pocket region indicate that a corrosion allowance of about 0.5 inch exists. The staff's review of the applicant's Structures Monitoring Program, ASME Section XI, Subsection IWE Program, and Appendix J Program is documented in SER Sections 3.0.3.1.3, 3.0.3.1.4, and 3.0.3.1.1 respectively. The LRA did not discuss condition four; therefore, by letter dated November 13, 2009, the staff issued RAI 3.5.2.2.1-1 requesting that the applicant discuss plant-specific operating experience related to water ponding on the containment floor, including frequency and resulting corrective actions.

In its response dated December 14, 2009, the applicant stated that DAEC has four floor drains or sumps on the containment floor outside of the RPV pedestal and two sumps inside the pedestal under the CRDs to collect any water leakage, thereby eliminating the potential for ponding. A review of OE for the last 10 years has shown no indications of ponding on the containment floor. Accessible areas of the drywell steel liner have not exhibited significant corrosion. The elastomer sealant at the junction of the drywell liner and the concrete floor is examined and maintained to preclude any leakage from entering the concrete or drywell liner joint. The concrete floor has not exhibited any significant cracking that may allow water, should leakage occur, to pass through to the steel liner. The applicant further stated that the ASME Section XI, Subsection IWE Program manages loss of material in the steel containment liner. Inaccessible areas of the liner inside containment are protected against general, pitting, and crevice corrosion by embedment in concrete and by a moisture barrier (elastomer sealant) that prevents water from reaching inaccessible areas. The Structures Monitoring Program will identify and manage any cracks in the concrete. Degradation of the moisture barrier that could potentially provide a pathway for water to reach inaccessible portions of the steel containment liner is managed by the ASME Section XI Subsection IWE program.

Since the applicant has systems in place to minimize water ponding on the containment floor, the staff finds the response acceptable and finds the applicant appropriately addressed the aging effect or mechanism.

The staff also reviewed the applicant's summary of the LR-ISG-2006-01 response. The ISG recommends applicant's demonstrate that the drywell shell will be able to fulfill its intended function during the period of extended operation. The ISG discusses establishing an applicable corrosion rate, and demonstrating that any observed degradation will not keep the drywell shell from performing its intended function. The applicant should also discuss possible environments which may lead to increased corrosion. The applicant has successfully addressed these issues by demonstrating that no measurable corrosion has taken place in susceptible areas (i.e., the sand pocket region) and that no moisture has been detected in the region. The applicant will continue to inspect the torus room basement near the sand pocket drain lines to ensure that moisture does not enter the sand pocket region.

Based on the applicant's use of ASME Section XI Subsection IWE, and 10 CFR Part 50, Appendix J as the AMPs for the period of extended operation; ultrasonic measurements indicating that no measureable corrosion has occurred in the drywell shell; and meeting the four conditions in GALL Report Item II.B1.1-2 to demonstrate that corrosion is not significant in inaccessible areas; the staff finds that the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.4 and demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Loss of Prestress Due to Relaxation, Shrinkage, Creep, and Elevated Temperature. In LRA Section 3.5.2.2.1.5, the applicant stated that DAEC has a Mark I free-standing steel containment that does not incorporate a post-tensioning system and that this aging effect is not applicable.

The staff finds acceptable the applicant's evaluation that this aging effect is not applicable on the basis that the containment is a free-standing steel containment with no post-tensioned concrete.

Cumulative Fatigue Damage. Cumulative fatigue damage is a TLAA. SER Section 4.6 documents the staff's review of the applicant's evaluation of this TLAA.

Cracking Due to Stress Corrosion Cracking. LRA Section 3.5.2.2.1.7 addresses SCC of penetration sleeves, penetration bellows, dissimilar metal welds, and vent line bellows. The applicant stated that these components may be susceptible to SCC. However, the applicant further stated that aging management is not required for stress corrosion crack initiation and growth of these stainless steel components subjected to the air or gas environment encountered at DAEC, because the environment does not contain aggressive contaminants.

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 stress corrosion cracking of stainless steel penetration sleeves, penetration bellows, and dissimilar metal welds could occur in all types of PWR and BWR containments. SRP-LR also states that cracking could occur for stainless steel vent line bellows for BWR containments.

The staff reviewed the LRA Section 3.5.2.2.1.7, and noted that the applicant provides two conflicting statements. The applicant stated that the components are susceptible; however, they may not be susceptible because of the environment. In its review, the staff noted that the LRA indicates stainless steel penetration sleeves, penetration bellows, dissimilar metal welds, and vent line bellows can potentially undergo SCC. However, LRA Section 3.5.2.2.1.7 also indicates that aging management is not needed for SCC for the air or gas environment because the environment is not aggressive and the material temperature is below 60 °C [140 °F]. By letter dated January 6, 2010, the staff issued RAI BF101-1 requesting that the applicant clarify whether it will be managing SCC of the above stainless steel components exposed to air or gas as described in Section 3.5.2.2.1.7.

In its response dated February 2, 2010, the applicant stated that it is not apparent that the SCC aging effect is applicable to the air environment where these components are exposed. Secondly, the applicant stated that the EPRI document 1010639, "Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools," Revision 4 states that stress corrosion cracking is not a significant aging mechanism below 60°C [140°F]. The applicant has stated that the environment where the stainless steel penetration sleeves, penetration bellows, and dissimilar metal welds are located does not contain aggressive contaminants and the materials are less than 60°C [140°F]. Therefore, the applicant has determined that SCC does not need to be considered for stainless steel penetration sleeves, penetration bellows, and dissimilar metal welds. The staff noted that the applicant has clarified that the penetration sleeves, penetration bellows, and dissimilar metal welds: (1) will not be managed for stress corrosion cracking, (2) are not in an environment that contains aggressive contaminants, and (3) are below the temperature of 60°C [140°F].

Based on the review, the staff finds the applicant's response to RAI BF101-1 acceptable because these stainless steel penetration sleeves, penetration bellows, and dissimilar metal welds exposed to air or gas are not located in an environment above a temperature of 60°C [140°F] that contains aggressive contaminants (e.g., chlorides or sulfates), which cause cracking due to SCC. Therefore, since these components are located in an environment not expected to contain aggressive contaminants, SCC is not likely to occur and as such does not need to be considered. The staff's concern described in RAI BF101-1 is resolved.

Since the applicant's containment environment does not contain a significant presence of contaminants and the materials temperature remains below 140 ºF, the staff agrees that additional inspections to detect SCC are not necessary. However, the staff was unclear if the required Appendix J and IWE inspections would continue to be carried out on these components. To address this, by letter dated November 13, 2009, the staff issued RAI 3.5.2.2.1-2 requesting that the applicant explain how the Appendix J leak rate testing program and IWE inspections will be conducted on penetration sleeves, bellows, dissimilar metal welds, and vent line bellows during the period of extended operation.

By letter dated December 14, 2009, the applicant responded that during the period of extended operation, it will continue to perform inspections in accordance with the requirements of ASME Section XI, Subsection IWE, and leak rate testing in accordance with the requirements of 10 CFR Part 50 Appendix J. The leak rate testing and the inspections will ensure that all pressure retaining components such as sleeves, bellows, welds, etc. will continue to perform their current licensing basis (CLB) functions during the period of extended operation.

Since the applicant has committed to the appropriate AMPs for the period of extended operation, the staff finds the response acceptable and finds the applicant appropriately addressed the aging effect or mechanism. The staff's concern described in RAI 3.5.2.2.1-2 is resolved.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.5.2.2.1.7 criteria. For those line items that apply to LRA Section 3.5.2.2.1.7, the staff determines that the LRA is consistent with the GALL Report and 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).

Cracking Due to Cyclic Loading. In LRA Section 3.5.2.2.1.8, the applicant stated that steel, stainless steel, and dissimilar metal weld components which are potentially susceptible to cracking due to cyclic loading at DAEC are: penetration sleeves, penetration bellows, suppression pool shell, and unbraced downcomers. For these components, cracking due to cyclic stress is an aging effect requiring management by the ASME Section XI IWE Program and 10 CFR 50 Appendix J Program for the period of extended operation.

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 (including welded joints), and penetrations (including penetration sleeves, dissimilar metal welds, and penetration bellows) could occur for all types of containments and BWR vent header, vent line bellows and downcomers. SRP-LR Section 3.5.2.2.1.8 also states that the existing program relies on ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J to manage this aging effect. The GALL Report recommends further evaluation for detection of this aging effect.

The staff reviewed the AMR and its associated AMPs in the LRA. The staff confirmed that plant-specific operating experience did not identify any events related to cyclic loading induced cracking of containment components. The staff also confirmed that the IWE and Appendix J programs will continue to manage aging of the components without fatigue analyses during the period of extended operation. The staff confirmed that fatigue analyses existed for the vent system, including the vent line bellows, and that the analyses were reviewed as TLAAs in SER Section 4.6. Since the applicant has committed to the appropriate AMP, and fatigue analyses exist which are being reviewed as TLAAs, the staff finds that the applicant appropriately addressed the further evaluation requirement with a TLAA, and no further evaluation is required in this section.

<u>Loss of Material (Scaling, Cracking, and Spalling) Due to Freeze-Thaw</u>. In LRA Section 3.5.2.2.1.9, the applicant stated that loss of material due to freeze-thaw is not applicable. The applicant stated that DAEC has a Mark I steel containment that is located in a reactor building. Loss of material (scaling, cracking, and spalling) due to freeze-thaw exposure is only applicable to concrete containments exposed to this environmental condition.

The staff reviewed LRA Section 3.5.2.2.1.9 against the criteria in SRP-LR Section 3.5.2.2.1.9, which recommends further evaluation of loss of material due to freeze-thaw for plants with concrete containments located in moderate to severe weathering conditions.

The staff finds acceptable the applicant's evaluation that this aging effect is not applicable because the primary containment is a free standing steel shell and this attribute is not applicable.

<u>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 stated that DAEC has a free-standing Mark I steel containment located in the reactor building. In LRA Table 3.5.2-7, the applicant stated that the containment concrete is used only to meet intended functions of shielding and structural support and that aging of the containment concrete is managed by the Structures Monitoring Program for cracking, loss of bond, loss of material (spalling, scaling), expansion and cracking, and increase in porosity and permeability. The LRA further states that concrete was constructed in accordance with the recommendations in ACI 201.2R-77; therefore, cracking of containment concrete due to expansion and reaction with aggregate, and increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide do not require aging management for the period of extended operation.

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. The GALL Report recommends further evaluation if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77.

The staff confirmed that the containment related concrete does not serve a pressure retaining function. Therefore, the staff finds that the concrete does not need to be evaluated for cracking due to expansion and reaction with aggregate, and increase in porosity and permeability due to leaching of calcium hydroxide in this section because it does not serve a containment pressure retaining function. SER Section 3.5.2.2.2, 'Aging of Structures Not Covered by Structures Monitoring Program, Item 5,' and 'Aging Management of Inaccessible Areas, Item 2,' document the staff's review of the applicant's evaluation of cracking due to expansion and reaction with aggregate for in-scope concrete. SER Section 3.5.2.2.2, 'Aging Management of Inaccessible Areas, Item 5,' documents the staff's review of the applicant's evaluation of increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide for in-scope concrete.

3.5.2.2.2 Safety-Related and Other Structures and Component Supports

The staff reviewed LRA Section 3.5.2.2.2 against the criteria in SRP-LR Section 3.5.2.2.2, which address several areas:

Aging of Structures Not Covered by Structures Monitoring Program. 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, including: (1) cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel for Groups 1-5, 7, and 9 structures; (2) increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack for Groups 1-5, 7, and 9 structures; (3) loss of material due to corrosion for Groups 1-5, 7, and 8 structures; (4) loss of material (spalling, scaling) and cracking due to freeze-thaw for Groups 1-3, 5, and 7-9 structures; (5) cracking due to expansion and reaction with aggregates for Groups 1-5 and 7-9 structures; (6) cracks and distortion due to increased stress levels from settlement for Groups1-3 and 5-9 structures; and (7) reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation for Groups 1-3 and 5-9 structures.

In addition, lock-up due to wear may occur for Lubrite radial beam seats in BWR drywells, and other sliding support bearings and sliding support surfaces. The existing program relies on the structures monitoring program or ASME Code Section XI, Subsection IWF, to manage this aging effect. The GALL Report recommends further evaluation only for structure-aging effect combinations not within the ISI (IWF) or Structures Monitoring programs.

The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.11. During its review, the staff noted that several subsections of 3.5.2.2.2.1 state that the condition of accessible areas is used to evaluate the condition of inaccessible areas; however, the subsections also state that the aging effects do not require management for the period of extended operation. The LRA makes no mention of inspections under the Structures Monitoring Program or any other AMP. The staff is unclear whether or not inspections will be conducted on accessible areas for the applicable structure/aging effect combinations during the period of extended operation. By letter dated November 13, 2009, the staff issued RAI 3.5.2.2.2.1-1 requesting the applicant to explain whether or not the structure/aging effect combinations discussed in the SRP-LR Section 3.5.2.2.2.1, subsections 1, 2, 4, and 5 will be inspected for accessible areas during the period of extended operation.

By letter dated December 14, 2009, the applicant responded that as indicated in LRA Tables 3.5.2-1 through 3.5.2-11, the Structures Monitoring Program is assigned as the AMP for the structure/aging effect combinations discussed in SRP-LR Section 3.5.2.2.2.1 (corresponds to LRA Section 3.5.2.2.2.1) and cross-referenced to Table 1 line items 3.5.1-23, 3.5.1-24, 3.5.1-26 and 3.5.1-27. As discussed in LRA Section B.3.37, the Structures Monitoring Program includes periodic visual inspection of structures and structural components for the detection of aging effects. Accessible concrete inspected under the Structures Monitoring Program provides an indication of the condition of inaccessible concrete, since both accessible and inaccessible concrete are constructed to the same standards and are exposed to similar environments.

Since the applicant has committed to the appropriate GALL Report recommended AMP for the period of extended operation, the staff finds the response acceptable and finds the applicant appropriately addressed the aging effect or mechanism covered by SRP-LR Section 5.5.2.2.2.1, subsections 1, 2, 4, and 5. No furthere evaluation is required because the structure/aging effect combinations are included within the scope of the applicant's Structures Monitoring Program. The following discussion addresses subsections 3, 6, 7, and 8, which were not addressed in RAI 3.5.2.2.2.1-1.

(3) Loss of Material Due to Corrosion for Groups 1-5, 7, and 8 Structures

In the LRA, the applicant stated that loss of material due to corrosion for Groups 1-5, 7, and 8 structures is an aging effect requiring management for the period of extended operation and is managed by the Structures Monitoring Program.

The staff confirmed that Groups 1-5, 7, and 8 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 since the structure/aging effect combination is included within the scope of the applicant's Structures Monitoring Program. The staff's review for the loss of material due to general, pitting and crevice corrosion for steel elements of containment is documented in SER Section 3.5.2.2.1.

(6) Cracks and Distortion Due to Increased Stress Levels from Settlement for Groups 1-3 and 5-9 Structures

In the LRA, the applicant stated that cracks and distortion due to increased stress levels from differential settlement of groups 1-3 and 5-9 structures are detected during structures monitoring routine inspections. The applicant also stated that a dewatering system is not used at DAEC. The applicant further stated that Seismic Category I structures are located on the top of limestone bedrock or soil and, therefore, these aging effects do not require management for the period of extended operation.

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 since the structure/aging effect combination is included within the scope of the applicant's Structures Monitoring Program. The staff's review for cracks and distortion due to increased stress levels from settlement for inaccessible concrete elements of Groups 1-3, 5, and 7-9 structures is documented in SER Section 3.5.2.2.2, 'Aging Management of Inaccessible Areas, Item 3.'

(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 the LRA, the applicant stated that Seismic Category I structures are located on top of rock or soil and include a lean Type II Portland cement concrete foundation and subfoundation. The applicant stated that neither porous concrete nor high aluminate cement were used for the foundation or subfoundation. The applicant also stated that these aging effects do not require management for the period of extended operation.

The staff confirmed that no porous subfoundations exist at DAEC; therefore, the staff agrees this aging affect is not applicable because DAEC has no porous concrete subfoundations.

(8) Lockup Due to Wear for Lubrite® Radial Beam Seats in BWR Drywell and Other Sliding Support Surfaces

In the LRA the applicant stated that EPRI 1015078 evaluates the aging effect and says that wear is not significant since there is insufficient relative motion and frequency due to thermal cycling during plant heat-up, cool-down, and normal operation. The applicant further stated that there is no known aging effect that would lead to loss of intended function. The applicant also stated that fretting or lockup due to mechanical wear is not significant for the steel drywell head and downcomers; therefore, loss of material of Lubrite or similar material due to wear is not an aging effect requiring management for the period of extended operation.

While reviewing this item the staff was unable to verify that these and other sliding support surfaces were being inspected for loss of function due to corrosion, distortion, dirt, overload, or fatigue. To address this, the staff issued RAI 3.5.2.2.2.1-2 by letter, dated November 13, 2009, asking the applicant to explain why inspections to detect loss of mechanical function due to corrosion, distortion, dirt, overload, or fatigue are unnecessary for sliding support surfaces (i.e., components related to Table 3.5-1, items 52 or 56). The applicant was requested to include the drywell radial beam seats (sliding supports) in this discussion.

The applicant responded by letter, dated December 14, 2009, referencing EPRI TR-1015078, “Plant Support Engineering: Aging Effects for Structures and Structural Components (Structural Tools),” which concluded that aging effects are not significant in fluoropolymers and lubrite sliding surfaces due to outstanding material properties, relatively low cycle application, and lack of industry experience on failures. The applicant further explained that Lubrite lubricants used in nuclear applications are designed for the environments to which they are exposed. They are designed with the ability to carry extremely heavy dynamic and static loads with a low coefficient of friction, to operate dry or wet in high or low temperature conditions, to withstand high intensities of radiation, and not to be susceptible to corrosion. An industry experience search did not find any Lubrite aging degradation that could lead to the loss of intended function. The response further stated for clarity, the LRA discussions of sliding surfaces in Table 3.5-1 are revised as follows: In LRA Table 3.5-1, Summary Of Aging Management Evaluations In Chapters II and III of NUREG-1801 “Structures And Structural Components,” item 52, on page 3.5-40, the Discussion entry is revised in its entirety to read as follows, “Loss of mechanical function due to corrosion, distortion, dirt, overload or fatigue is not an aging effect requiring management. Such failures typically result from inadequate design or operating events rather than from the effects of aging. Failures due to cyclic thermal loads are rare for structural supports due to their relatively low temperatures.” In LRA Table 3.5-1, Summary Of Aging Management Evaluations In Chapters II and III of NUREG-1801 “Structures And Structural Components,” item 56, on page 3.5-40, the Discussion entry is revised in its entirety to read as follows, “Lubrite plates are used in the torus support saddles at DAEC. Lubrite materials for nuclear applications are designed to resist deformation, have a low coefficient of friction, resist softening at elevated temperatures, resist corrosion, withstand high intensities of radiation, and will not score or mar; therefore, they are not susceptible to aging effects requiring management." Nonetheless, lubrite components associated with the torus supports are included in the ASME Section XI Inservice Inspection, Subsection IWF Program. The radial beam seats in the drywell are discussed in LRA Table 3.5-1, item 30, on page 3.5-33, and in LRA Section 3.5.2.2.2.1.8.

Since the applicant has committed to the appropriate GALL Report recommended AMP (ASME Section XI, Subsection IWF) for the period of extended operation, the staff finds the response acceptable and finds the applicant appropriately addressed the aging effect or mechanism.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.5.2.2.2.1 criteria. 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 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).

Aging Management of Inaccessible Areas. The staff reviewed LRA Section 3.5.2.2.2.2 against the following criteria in SRP-LR Section 3.5.2.2.2.2:

(1) Loss of material (spalling, scaling) and cracking due to freeze-thaw could occur in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures.

In LRA Section 3.5.2.2.2.2.1, the applicant stated that the plant is located in a severe weathering area and, therefore, an evaluation was performed to determine if freeze-thaw cycles will have an effect on concrete structures. The applicant stated that the concrete had an air content between three and six percent, and subsequent inspections performed on concrete in accessible areas did not identify degradation related to freeze-thaw. The applicant stated that the concrete was constructed in accordance with the recommendations in American Concrete Institute (ACI) 201.2R-77 for durability; materials used in the concrete mixes conformed to American Society for Testing and Material (ASTM) specifications that ensure consistent, reliable concrete of the highest quality. The applicant also stated that these aging effects do not require aging management for the period of extended operation.

The staff reviewed LRA Section 3.5.2.2.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.2.2.1, which states that the GALL Report recommends further evaluation of this aging effect for inaccessible areas of these groups of structures for plants located in moderate to severe weathering conditions. The GALL Report suggests that the existing concrete have an air content of three to six percent. The GALL Report also suggests a water-to-cement ratio between 0.35 and 0.45 for concrete exposed to potential freeze-thaw conditions.

The staff noted that in LRA Section 3.5.2.2.2.2.1 a water-to-cement ratio is not specified for concrete. To address this issue, by letter dated November 13, 2009, the staff issued RAI 3.5.2.2-1 asking the applicant to: (1) provide the water-to-cement ratio (w/c) for the concrete used in Groups 1-3, 4-6, and 7-9 structures, and (2) if the ratio (w/c) is outside the range provided in the SRP-LR, explain how the aging effect will be managed during the period of extended operation focusing on additional inspections or evaluations that may be necessary, or explain why the current Structures Monitoring Program is adequate.

By letter dated December 14, 2009, the applicant responded:

(1) The maximum w/c ratio at DAEC is 0.47 for 3000 psi concrete strength and 0.44 for 4000 psi concrete strength.

(2) The w/c ratio for the concrete used in Groups 1-3, 4-6, and 7-9 was based on ACI 318-63 Section 502 method 2. Method 2 was used for tests of trial mixes to ensure required concrete strength at w/c ratios that provided sufficient workability. The maximum permissible w/c ratio for the concrete used at DAEC was established by the w/c 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 w/c ratio was 0.47 for concrete with 3000 psi strength and 0.44 for concrete with 4000 psi strength. The Structures Monitoring Program performs inspections of concrete in accessible areas for loss of material (spalling, scaling) and cracking due to freeze-thaw. As discussed in LRA Section 3.5.2.2.2.2.1, inspections of accessible areas have confirmed that concrete has not exhibited degradation due to freeze-thaw. Inspection results from accessible areas are used as an indicator for inaccessible areas. As discussed in LRA Section B.3.37.1, the Structures Monitoring Program includes examinations of areas not typically accessible, such as buried concrete foundations. These examinations will be completed when the opportunity arises, such as during excavations. An evaluation of these opportunistic inspections for buried concrete will be completed every 10 years to ensure that the condition of buried concrete foundations on site is characterized sufficiently to provide reasonable assurance that the foundations on site will perform their intended function through the period of extended operation. Additional inspections may be performed in the event that an opportunistic inspection has not been conducted, or if visible portions of the concrete foundation reveal degradation. The Structures Monitoring Program has been effective in managing aging effects in concrete and masonry structures.

The staff reviewed the applicant's response and finds it acceptable. The difference between the GALL Report maximum w/c ratio of 0.45 and the applicant w/c ratio of 0.47 is negligible, and the applicant air content falls within the GALL Report limits. Therefore, the staff finds that the concrete mix design addressed freeze-thaw damage potential by using entrained air and appropriate w/c ratio for structures subject to freezing in the subgrade freeze zone and in water-control structures. In addition, the Structures Monitoring Program includes opportunistic inspections of inaccessible concrete when it is exposed for any reason. Furthermore, potential freeze-thaw effects on the inaccessible concrete are assessed by monitoring the accessible concrete under the Structures Monitoring Program. These assessments have not identified concrete degradation related to freeze-thaw. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.11.

On the basis of its review, the staff finds that the loss of material (spalling, scaling) and cracking due to freeze-thaw in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures is not significant. Therefore, no additional plant-specific program is required.

(2) Cracking due to expansion and reaction with aggregates could occur in below-grade inaccessible concrete areas for Groups 1-5 and 7-9 structures.

In LRA Section 3.5.2.2.2.2.2, the applicant stated that concrete in inaccessible areas is evaluated for expansion and cracking due to reaction with aggregate, and that tests and petrographic examinations were performed according to ASTM C289-64 and ASTM C295-54 to verify that aggregates used were not reactive. The applicant also stated that these aging effects do not require aging management for the period of extended operation.

The staff reviewed LRA Section 3.5.2.2.2.2.2 against the criteria in SRP-LR Section 3.5.2.2.2.2.2, which states that the GALL Report recommends further evaluation of inaccessible areas of these Groups of structures if the concrete was not constructed in accordance with the recommendations in ACI 201.2R-77. GALL Report item III.A1-2 states that investigations, tests, and petrographic examinations of aggregates performed in accordance with ASTM C295-54 or ASTM C227-50 can demonstrate that the aggregate is not reactive within the reinforced concrete. If either of these conditions is met, the GALL Report notes that aging management is not necessary.

The staff found that the concrete mix design adequately addressed cracking due to expansion and reaction with aggregates. The staff reviewed UFSAR Table 3.8-2, "Aggregate Tests," which listed tests that were conducted in accordance with the GALL Report identified ASTM specifications to qualify the aggregate materials for soundness and reactivity to demonstrate that the aggregates will produce durable concretes. The aggregate materials were evaluated in accordance with ASTM C295-54 and found to be nonreactive. Also, the staff confirmed in the UFSAR that all concrete work was in accordance with ACI 318-63 and that the concrete was constructed in accordance with recommendations in ACI 201.2R-77.

On the basis of its review, the staff finds that the aggregates used are nonreactive, and the concrete was constructed in accordance with the requirements of ACI 318-63 and recommendations in ACI 201.2R-77. Therefore, cracking due to expansion and reaction with aggregate in below-grade inaccessible concrete areas for Groups 1-5 and 7-9 structures are not aging effects for concrete elements and no additional plant-specific program is required.

(3) Cracks and distortion due to increased stress levels from settlement and reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations could occur in below-grade inaccessible concrete areas of Groups 1-3, 5, and 7-9 structures.

In LRA Section 3.5.2.2.2.2.3, the applicant stated that seismic Category I structures are located on the top of rock or on soil. For the structures built on rock, the ground was excavated to the top of rock then a subfoundation that consisted of fill with lean concrete was placed on the top of rock; and then, the mat foundation was placed on the top of the subfoundation. Buildings located on soil were supported primarily on compacted granular backfill material placed in contact with the natural glacial till soils or placed over bedrock, then, the mat foundation was placed on the top of the backfill. The applicant stated that: (1) cement used in both the foundation and the subfoundation was low alkali Type II Portland cement, (2) a porous concrete foundation is not present, and (3) calcium aluminate cement was not used. In the discussion section of LRA Table 3.5-1, item 3.5.1-28, the applicant stated that a de-watering system is not used at DAEC. The applicant stated in the LRA that general differential settlement in all seismic Category I buildings can be detected during the Maintenance Rule inspections, which implements the Structures Monitoring Program, because the effects of settlement could be visible on concrete structures in the form of cracking near areas of stress concentration, such as at discontinuities and large penetrations. The applicant also stated that these aging effects do not require management for the period of extended operation.

The staff reviewed LRA Section 3.5.2.2.2.2.3 against the criteria in SRP-LR Section 3.5.2.2.2.2.3, which states that the GALL Report recommends verification of the continued functionality of the dewatering system during the period of extended operation if the plant's CLB credits a dewatering system. The GALL Report recommends no further evaluation if this activity and these aging effects are included in the scope of the applicant's Structures Monitoring Program.

On the basis of its review, the staff determined that cracks and distortion due to increased stress levels from settlement and reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations in below grade inaccessible concrete areas of Groups 1-3, 5, and 7-9 structures are not plausible aging effects due to the absence of these aging mechanisms. DAEC does not use a dewatering system, and there are no porous subfoundations on the site. In addition, the applicant monitors the above-grade exposed concrete for the aging effect of cracking due to settlement under the Structures Monitoring Program. The staff reviewed the Structures Monitoring Program, and the evaluation is documented in SER Section 3.0.3.2.11. The staff finds that this program is consistent with the recommendations in the GALL Report, and is adequate to manage cracks and distortion due to increased stress levels from settlement, reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundation.

(4) Increase in porosity and permeability, cracking and loss of material (spalling, scaling) due to aggressive chemical attack, and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel could occur in below-grade inaccessible concrete areas of Groups 1-3, 5, and 7-9 structures.

In LRA Section 3.5.2.2.2.2.4, the applicant stated that concrete in inaccessible areas is evaluated for increase in porosity and permeability, cracking and loss of material (spalling, scaling) due to aggressive chemical attack, and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel. The applicant stated that: (1) plant documents confirm that the below-grade environment is not aggressive (pH greater than 7, chlorides less than 100 ppm, and sulfates less than 100 ppm), (2) the Structures Monitoring Program includes examinations of below grade concrete when excavated for any reason, (3) evaluation of conducted opportunistic inspections will be completed every 10 years to ensure that the condition of the buried concrete foundations on site is characterized, and (4) the condition of the accessible areas is used to evaluate the condition of the inaccessible areas. To ensure that the below-grade environment remains non-aggressive, the applicant stated that the groundwater chemistry is monitored periodically for the above parameters as part of the Structures Monitoring Program. The applicant also stated that these aging effects do not require aging management for the period of extended operation.

The staff reviewed LRA Section 3.5.2.2.2.2.4 against the criteria in SRP-LR Section 3.5.2.2.2.2.4, which states that the GALL Report recommends further evaluation of plant-specific programs to manage these aging effects in inaccessible areas of these

Groups of structures if the environment is aggressive. For inaccessible areas the GALL Report item II.B1.1-2 recommends for plants that have non-aggressive groundwater/soil (e.g., pH greater than 5.5, chlorides less than 500 ppm, and sulfates less than 1,500 ppm) periodic monitoring of below-grade water chemistry, including consideration for seasonal variations, and examination of exposed portions of below-grade concrete when excavated for any reason.

The staff noted that the applicant's groundwater inspection program is under the Structures Monitoring Program and that groundwater samples taken at shallow wells and from site production wells indicate that the groundwater is not aggressive. The staff noted in the LRA that the groundwater inspection interval is 10 years, however, recent groundwater sampling results were not provided, and an explanation was not included to demonstrate that the groundwater samples obtained to date indicated seasonal variations or were representative of the groundwater in contact with safety-related and important-to-safety embedded concrete foundations. By letter dated September 14, 2009, RAI B.3.37-1 and RAI B.3.37-2 were issued to address these items.

By letter dated October 13, 2009, the applicant responded to the RAIs by providing recent groundwater sample results which meet the GALL Report limits. The response also explained the adequacy of the inspection interval and explained how the groundwater sample locations provided an appropriate indication of the environment to which inaccessible concrete structures are exposed. The staff did not agree that the inspection intervals discussed in the RAI responses were appropriate; therefore, by letters dated January 6 and February 22, 2010, the staff issued follow-up RAIs. In response to the follow-up RAIs, the applicant committed to monitoring groundwater on a 5-year frequency. A more detailed explanation of the staff's review of the applicant's Structures Monitoring Program, including responses to RAI B.3.37-1 and RAI B.3.37-2, is documented in SER Section 3.0.3.2.11.

On the basis of its review, the staff finds that the increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures is adequately managed because groundwater chemistry inspection results show that the environment is not aggressive, accessible areas are used to evaluate the condition of the inaccessible areas, and evaluation of conducted opportunistic inspections will be completed every 10 years to ensure that the condition of the buried concrete foundations on site is characterized sufficiently to provide reasonable assurance that the site foundations will perform their intended function through the period of extended operation.

(5) Increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide could occur in below-grade inaccessible concrete areas of Groups 1-3, 5, and 7-9 structures

In LRA Section 3.5.2.2.2.2.5, the applicant stated that concrete in inaccessible areas is evaluated for increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide. The applicant stated that plant documents confirm that the concrete was constructed in accordance with the recommendations in ACI 201.2R-77 for durability; materials used in the design conformed to ASTM specifications that ensure consistent, reliable concrete of the highest quality; aggregates conformed to the requirements of ASTM C-33 and were accepted based on ASTM C-295 (petrographic), ASTM C-289 (reactivity), and other tests; concrete mix proportions were in accordance with ACI 613 (superseded by ACI 211.1); and mixing and delivering of concrete was in accordance with ACI standards for hot and cold weather conditions (ACI 306 and ACI 605). The applicant also stated that these aging effects do not require aging management for the period of extended operation.

The staff reviewed LRA Section 3.5.2.2.2.2.5 against the criteria in SRP-LR Section 3.5.2.2.2.2.5, which states that the GALL Report recommends further evaluation of this aging effect for inaccessible areas of Groups 1-3, 5, and 7-9 structures if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77.

The staff confirmed that the plant concrete met the intent of the recommendations in ACI 201.2R-77. A more detailed discussion of the staff's review of the applicant's concrete relative to ACI 201.2R-77 recommendations and assessments of the aggregate materials relative to pertinent ASTM standard guides and test methods is documented in SER Section 3.5.2.2.2,'Aging Management of Inaccessible Areas, Items 1 and 2.'

On the basis of its review, the staff finds that increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures is not a plausible aging effect requiring management because the concrete for these structure Groups was constructed in accordance with ACI 201.2R-77 as recommended in the GALL Report and meets the criteria in SRP-LR Section 3.5.2.2.2.2.5.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.5.2.2.2.2 criteria. For those line items that apply to LRA Section 3.5.2.2.2.2, the staff determines that the LRA is consistent with the GALL Report and 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>Reduction of Strength and Modulus of Concrete Structures Due to Elevated Temperature</u>. In LRA Section 3.5.2.2.2.3 the applicant addresses reduction of concrete strength and modulus due to elevated temperatures that may occur in BWR Groups 1-5 concrete structures. The applicant stated that Group 1-5 concrete elements do not exceed the temperature limits associated with aging degradation due to elevated temperature as specified in ACI 349 for normal operations or any other long-term period. The applicant also stated that these aging effects do not require management for the period of extended operation.

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 may occur in PWR and BWR Groups 1-5 concrete structures. ACI 349-85 specifies the concrete temperature limits for normal operation or any other long-term period and states that general area temperatures shall not exceed 65 °C (150 °F) except for local areas that are permitted to have temperatures not to exceed 93 °C (200 °F). The GALL Report recommends further evaluation of a plant-specific program if any portion of the safety-related and other concrete structures exceeds these limits.

The staff noted that in the LRA, the applicant stated that Group 1-5 concrete elements do not exceed temperature limits associated with aging degradation due to elevated temperature. The applicant stated that the area having the highest ambient air temperature is in the containment drywell. In LRA Section 3.5.2.2.1.3, the applicant stated that the drywell cooling system maintains the drywell ambient air temperatures to less than 66 °C (150 °F) and there are no local area temperatures greater than 93 °C (200 °F).

On the basis of its review, the staff finds that reduction in strength and modulus of elasticity due to elevated temperatures in concrete areas of Groups 1-5 structures is not a plausible aging effect requiring management because concrete temperatures are below limits specified in ACI 349-85. Therefore, the staff agrees that this is not an AERM for these components because the necessary condition does not exist.

Based on the above, the staff concludes that the applicant meets SRP-LR Section 3.5.2.2.2.3 criteria. 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>Aging Management of Inaccessible Areas for Group 6 Structures</u>. The staff reviewed LRA Section 3.5.2.2.2.4 against the following criteria in SRP-LR Section 3.5.2.2.2.4:

(1) Increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel could occur in below-grade inaccessible concrete areas of Group 6 structures.

In LRA Section 3.5.2.2.2.4.1, the applicant stated that concrete in inaccessible areas is evaluated for these aging effects. The applicant stated that: (1) plant documents confirm that the below-grade environment is not aggressive (pH greater than 6.6, chlorides less than 200 ppm, and the sulfates less than 470 ppm); (2) the above aging effects are managed under the Structures Monitoring Program that also includes examinations of below-grade concrete when excavated for any reason; (3) the condition of the accessible area is used to evaluate the condition of the inaccessible area; and (4) to ensure the below-grade environment remains non-aggressive, groundwater sampling for the above parameters is monitored periodically as part of the Structures Monitoring Program. The applicant also stated that these aging effects do not require aging management for the period of extended operation.

The staff reviewed LRA Section 3.5.2.2.2.4.1 against the criteria in SRP-LR Section 3.5.2.2.2.4.1, which states that the GALL Report recommends further evaluation of plant-specific programs to manage these aging effects in inaccessible areas if the environment is aggressive.

The staff's review for these aging effects for inaccessible concrete elements of Groups 1-3, 5, and 7-9 structures is documented in SER Section 3.5.2.2.2, 'Aging Management of Inaccessible Areas, Item 4.' The staff noted that inspections of Group 6 structures are performed under the Structures Monitoring Program which is consistent with and incorporates the elements of RG 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants Program." The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.11. The staff confirmed that Group 6 structures subject to this AMR are in-scope of the Structures Monitoring Program.

The staff finds that since the environment is not aggressive, the applicant has enhanced the Structures Monitoring Program to include periodic groundwater sampling, and the applicant has included an evaluation of opportunistic inspections that will be completed every 10 years to ensure that the condition of the buried concrete foundations on site is characterized sufficiently to provide reasonable assurance that the site foundations will perform their intended function through the period of extended operation. Therefore, the criteria of SRP-LR 3.5.2.2.2.4.1 have been met.

(2) Loss of material (spalling, scaling) and cracking due to freeze-thaw could occur in below-grade inaccessible concrete areas of Group 6 structures.

In LRA Section 3.5.2.2.2.4.2, the applicant stated that concrete in inaccessible areas is evaluated for these aging effects. The applicant stated that the plant is located in a severe weathering region, plant documents confirm that the concrete had air content between three and six percent, and subsequent inspections performed on concrete in accessible areas did not exhibit degradation related to freeze-thaw. In LRA Tables 3.5.2-1 through 3.5.2-11, the applicant identified the Structures Monitoring Program as the AMP for this aging effect for accessible concrete areas. The applicant also stated that these aging effects do not require aging management for the period of extended operation.

The staff reviewed LRA Section 3.5.2.2.2.4.2 against the criteria in SRP-LR Section 3.5.2.2.2.4.2, which states that 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 inspections of Group 6 structures are performed under the Structures Monitoring Program which is consistent with and incorporates the elements of RG 1.127," Inspection of Water-Control Structures Associated with Nuclear Power Plants Program." The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.11. The staff confirmed that Group 6 structures subject to this AMR are in-scope of the Structures Monitoring Program.

Since the applicant's concrete adequately addressed freeze-thaw damage potential in the subgrade freeze zone and in water-control structures, as discussed in SER SER Section 3.5.2.2.2, 'Aging Management of Inaccessible Areas, Item 1,' the staff finds that criteria of SRP-LR Section 3.5.2.2.4.2 have been met.

(3) Cracking due to expansion and reaction with aggregates and increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide could occur in below-grade inaccessible reinforced concrete areas of Group 6 structures.

In LRA Section 3.5.2.2.2.4.3, the applicant stated that concrete in inaccessible areas is evaluated for expansion and cracking due to reaction with aggregate. In LRA Tables 3.5.2-1 through 3.5.2-11, the applicant identified the Structures Monitoring Program as the AMP for these aging effects for accessible concrete areas. The applicant also stated that these aging effects do not require aging management for the period of extended operation

The staff reviewed LRA Section 3.5.2.2.2.4.3 against the criteria in SRP-LR Section 3.5.2.2.2.4.3, which states that the GALL Report recommends further evaluation of inaccessible areas if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77.

The staff noted that inspections of Group 6 structures are performed under the Structures Monitoring Program which is consistent with and incorporates the elements of RG 1.127," Inspection of Water–Control Structures Associated with Nuclear Power Plants Program." The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.11. The staff confirmed that Group 6 structures subject to this AMR are in-scope of the Structures Monitoring Program.

The staff finds that since the applicant's concrete was constructed in accordance with ACI 201.2R-77 and the aggregate materials were tested to demonstrate that the aggregates will produce durable concretes, as discussed in SER Section 3.5.2.2.2, 'Aging Management of Inaccessible Areas, Item 2,' further evaluation is not necessary and the criteria of SRP-LR Section 3.5.2.2.2.4.3 have been met for cracking due to expansion and reaction with aggregates.

In LRA Section 3.5.2.2.2.4.3, the applicant further stated that concrete in inaccessible areas is evaluated for increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide, and that plant documents confirm that the concrete was constructed in accordance with recommendations in ACI 201.2R-77 for durability. In LRA Table 3.5.2, the applicant identified the Structures Monitoring Program as the AMP for these aging effects for accessible concrete areas. The applicant also stated that these aging effects do not require aging management for the period of extended operation.

The staff noted that inspections of Group 6 structures are performed under the Structures Monitoring Program which is consistent with and incorporates the elements of RG 1.127," Inspection of Water-Control Structures Associated with Nuclear Power Plants Program."

Since the applicant's concrete was constructed in accordance with ACI 201.2R-77 recommendations, as discussed in SER Section 3.5.2.2.2, 'Aging Management of Inaccessible Areas, Item 5,' the staff finds that further evaluation is not necessary, and the criteria of SRP-LR Section 3.5.2.2.2.4.3 have been met for increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.5.2.2.2.4 criteria. For those line items that apply to LRA Section 3.5.2.2.2.4, the staff determines that the LRA is consistent with the GALL Report and 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>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 stated that there are no components at DAEC that are subject to this aging effect.

The staff reviewed LRA Section 3.5.2.2.2.5 against the criteria in SRP-LR Section 3.5.2.2.2.5, which 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 confirmed that there are no stainless steel tank liners within the scope of license renewal. Since there are no components within scope, the staff agrees that this aging effect does not apply.

Aging of Supports Not Covered by the Structures Monitoring Program.

(1) Loss of Material Due to General and Pitting Corrosion, for Groups B2-B5 Supports

In LRA Section 3.5.2.2.2.6.1, the applicant stated that loss of material due to general and pitting corrosion for Groups B2-B5 supports is an aging effect requiring management for the period of extended operation. The Structures Monitoring Program will be used to manage this aging effect for Group B1-B5 Supports.

The staff reviewed LRA Section 3.5.2.2.2.6.1 against the criteria in SRP-LR Section 3.5.2.2.2.6, which states that further evaluation is necessary only for structure and aging effect combinations not covered by the structures monitoring program.

The staff confirmed that the component support and aging effect combination of loss of material due to general and pitting corrosion for Groups B2-B5 supports is managed by the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.11.

The staff finds that the credited AMP is appropriate because the Structures Monitoring Program performs visual inspections on a periodic basis to manage corrosion. Since the applicant has committed to an appropriate AMP for the period of extended operation, the staff finds these AMR results to be acceptable.

(2) Reduction in Concrete Anchor Capacity Due to Degradation of the Surrounding Concrete, for Groups B1-B5 Supports

In LRA Section 3.5.2.2.2.6.2, the applicant stated that reduction in concrete anchor capacity due to degradation of the surrounding concrete is an aging effect requiring management for the period of extended operation. The Structures Monitoring Program will be used to manage this aging effect for Group B1-B5 Supports.

The staff reviewed LRA Section 3.5.2.2.2.6.2 against the criteria in SRP-LR Section 3.5.2.2.2.6, which states that further evaluation is necessary only for structure and aging effect combinations not covered by the structures monitoring program. The staff confirmed that the component support and aging effect combination of reduction in concrete anchor capacity due to degradation of the surrounding concrete for Groups B1-B5 supports is managed by the Structures Monitoring Program. The staff's review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.11.

The staff finds that the credited AMP is appropriate because the Structures Monitoring Program performs visual inspections on a periodic basis to manage reduction in concrete anchor capacity due to degradation of the surrounding concrete. Since the applicant has committed to an appropriate AMP for the period of extended operation, the staff finds these AMR results to be acceptable.

(3) Reduction and Loss of Isolation Function Due to Degradation of Vibration Isolation Elements, for Group B4 Supports

In LRA Section 3.5.2.2.2.6.3, the applicant stated that the AMR did not identify any component support structure and aging effect combination which corresponded to GALL Report item III.B4.12.

The staff confirmed that no components applied to this AERM.

Based on the programs identified, the staff concludes that the applicant's programs meet SRP-LR Section 3.5.2.2.2.6 criteria. 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 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).

Cumulative Fatigue Damage Due to Cyclic Loading. LRA Section 3.5.2.2.2.7 states that fatigue is a TLAA and is addressed in Section 4.0.

The staff's evaluation of the Class 1 component supports metal fatigue TLAA is documented in SER Section 4.3.

3.5.2.2.3 Quality Assurance for Aging Management of Nonsafety-Related Components

The staff reviewed LRA Section 3.5.2.2.3 against the criteria in SRP-LR Section 3.5.2.2.3, which address several areas:

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA program.

3.5.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Tables 3.5.2-1 through 3.5.2-10, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

In LRA Tables 3.5.2-1 through 3.5.2-10, the applicant indicated, via notes F through J, that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects. Specifically, note F indicates that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicates that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicates that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicates that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicates that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

For component type, material, and environment combinations not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant has demonstrated that the effects of aging will be adequately managed so that the intended 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 Separation, Environmental Degradation, and Water In-Leakage of Elastomers

The staff reviewed LRA Table 3.5.2-1, which summarizes the results of AMR evaluations for the primary containment component groups.

In LRA Tables 3.5.2-1 through 3.5.2-11, for the component type ‘built-up roofing,’ the applicant proposed to assign elastomer, Table 3.5-1, item 3.5.1-44 (III.A6-12) to the Structures Monitoring Program, to manage the aging effects of separation, environmental degradation, and water in-leakage in an atmosphere and weather external environment. This line item references note H and plant-specific note 505, which states that, “Built-up roofing is not in NUREG-1801, III.A6-12 is for elastomer-material is similar, environment is same, and aging management program is Structures Monitoring Program.” The applicant stated that the Structures Monitoring Program is visual based, and utilizes guidance and criteria contained in ACI 349.3R that addresses waterproofing membranes for signs of separation, environmental degradation, or water leakage presence in joints or joint material. The staff’s review of the Structures Monitoring Program is documented in SER Section 3.0.3.2.11. The staff finds that the credited AMP is appropriate because the Structures Monitoring Program performs visual inspections on a periodic basis to manage roofing material aging effects of separation, environmental degradation, water in-leakage and weathering. Since the applicant has committed to an appropriate AMP for the period of extended operation, the staff finds this AMR result 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, as required by 10 CFR 54.21(a)(3).

3.5.2.3.2 Cracking and Delamination of Non-Metallic Fire Proofing

The staff reviewed LRA Table 3.5.2-2, which summarizes the results of AMR evaluations for the reactor building component groups.

In LRA Table 3.5.2-2, the applicant stated that structural steel non-metallic fire proofing exposed to air-indoor uncontrolled (external) has an aging effect of cracking and delamination, and that the aging effect will be managed by the Fire Protection Program. The AMR line items cite generic note H, indicating that the aging effect is not in the GALL Report for this component, material and environment combination. The applicant also specified plant-specific footnote 506, indicating that component is cementitious fire proofing and insulating material and will exhibit similar aging effects as concrete.

The staff reviewed all AMR result lines (unique items) in the GALL Report where the component type is cementitious fire proofing and insulating material, and confirmed that there are no entries for this component where aging effect is cracking and delaminating. However, the applicant also referenced Table 3.3.1, item 3.3.1-65 and the GALL Report item VII.G-28. The GALL Report item VII.G-28 is for reinforced concrete in an air-indoor, uncontrolled environment with an aging effect of concrete cracking and spalling.

The staff issued RAI 3.5.2.3.2-1 by letter dated November 13, 2009, noting that since the line item is not consistent with the GALL Report and a GALL Report line item was referenced, the applicant was requested to provide justification of how the Fire Protection Program will manage the aging effects of cracking and delamination, and to provide inspection methods and acceptance criteria to detect delamination.

In a letter dated December 14, 2009, the applicant responded that the non-metallic fireproofing is managed by the Fire Protection Program to ensure the fireproofing coverage is continuous and contains no areas in which the underlying beam or column is visible. The applicant explained that the aging effect that could result if the beams or columns become visible (indicating a potential for direct exposure of the structural steel to fire) would be cracking. The Fire Protection Program, as enhanced, inspects 100 percent of the fireproofing material on structural steel during each 5-year period to ensure any cracking is detected prior to loss of intended function. Any damage noted during the inspections is brought to the attention of the Fire Protection Engineer for determination of repair options. The applicant further stated that delamination of this fireproofing material should not have been listed in the LRA as an applicable aging effect requiring management. Therefore, delamination will be deleted from this line item in LRA Table 3.5.2-2 and in Section, 3.5.1.2, as noted below. NUREG-1801 item VII.G-28 is for Structural Fire Barriers with a material of reinforced concrete, environment of air-indoor uncontrolled, and an aging effect of cracking that is managed by the Fire Protection Program and the Structures Monitoring Program. This line item for reinforced concrete is a reasonably close match for the cementitious fireproofing material installed on structural steel. Therefore, with the removal of delamination as an aging effect for this material, the note H in this line item should be changed to note B. To reflect this response, the applicant explained that the LRA is revised as follows: In LRA Section 3.5.1.2, Control Building, on page 3.5-3, under Aging Effects Requiring Management, the bullet "Cracking, delamination" is deleted. In LRA Table 3.5.2-2, Summary of Aging Management Review Results Control Building, on page 3.5-50, in the line item for structural steel fireproofing with a listed Aging Effect Requiring Management of Cracking, delamination, the Aging Effect Requiring Management entry is changed to Cracking and the Notes entry is changed to B.

Since the applicant has committed to the appropriate GALL Report recommended AMP, as denoted by Generic Note B, for the period of extended operation, the staff finds the response acceptable and finds the applicant has appropriately addressed the aging effect.

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).

3.5.2.3.3 Change in Material Properties and Cracking of Elastomer Pressure Barrier Components

The staff reviewed LRA Table 3.5.2-7, which summarizes the results of AMR evaluations for the primary containment structures group.

In LRA Table 3.5.2-7 the applicant stated that for elastomer containment pressure barrier components exposed to indoor uncontrolled air, the aging effects of change in material properties and cracking are managed by the ASME Section XI, Subsection IWE Program. The applicant referenced GALL Item 3.5.1-16 and generic note H for these items, indicating that the aging effect of this component, material and environment combination is not evaluated in the GALL Report.

The staff evaluated the applicant's claim that the aging effect for this component, material, and environment combination is not evaluated in the GALL Report. The staff reviewed all AMR result lines in the GALL Report and found none where the material is elastomers, the environment is indoor or outdoor uncontrolled air, and the aging effect is change in material properties, or cracking.

The staff evaluated the use of elastomers in an indoor uncontrolled air environment. The staff noted that these items are typically made of rubber-like polymers and are designed for use in an outdoor or indoor air environment without significant degradation. The staff reviewed the applicant's IWE Program and its evaluation is documented in SER Section 3.0.3.1.4. The staff noted that the applicant's IWE Program includes periodic visual inspections of containment pressure retaining components for change in material properties, cracking, wear, and loss of material. The staff also noted that degradation such as cracking, delamination or loss of material would be detectable during a visual inspection. The staff further noted that required Appendix J pressure tests would also identify loss of leak tightness due to degradation of the elastomer components. The staff finds that the aging effects of change in material properties and cracking, for elastomer containment pressure barrier components exposed to an indoor uncontrolled air environment can therefore be adequately managed by periodic visual inspection in accordance with the ASME Section XI, Subsection IWE Program.

On the basis of its review, the staff finds that the applicant has appropriately evaluated the AMR results of material, environment, AERM, and AMP combinations not evaluated in the GALL Report. The staff finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.4 Change in Material Properties and Cracking of Elastomer Pressure Barrier Components

The staff reviewed LRA Table 3.5.2-2, which summarizes the results of AMR evaluations for the control building group.

In LRA Tables 3.5.2-2, the applicant added gypsum wall and glass partition in scope of license renewal and subject to an AMR and the Fire Protection Program to manage the aging effects of cracking in air indoor controlled environment. In the Notes for Tables 3.5.2-1 through 3.5.2-11, under Plant-Specific Notes, on page 3.5-127, a new note 515 is added to read as follows: 515. Gypsum is used as a 1 hour fire rated partition between the control room, computer room and control panel area. The partition is inspected by fire protection personnel.

Table 3.5.2-2, Summary of Aging management review results, Control building, the following line entries are added for “Control room 1 hour fire rated smoke and heat partition wall” and “Control Room Wire embedded glass smoke and heat partition wall.”

The staff finds that the credited AMP is appropriate Fire Protection Program performs visual inspections on a periodic basis to manage material aging effects of cracking in air indoor controlled environment. Since the applicant has committed to an appropriate AMP for the period of extended operation, the staff finds this AMR result 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, as required by 10 CFR 54.21(a)(3).

3.5.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the containments, structures, and components supports components within the scope of license renewal and subject to an AMR, will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3)

3.6 Aging Management of Electrical and Instrumentation and Controls

This section of the SER documents the staff's review of the applicant's AMR results for the electrical and I&C system components and component groups of:

- Transmission conductors and connections
- Insulated cables and connections
- Electrical Connections
- Fuse Holders
- Switchyard bus and connections
- Metal-Enclosed Bus
- High-Voltage Insulators
- Electrical Penetration Assemblies

3.6.1 Summary of Technical Information in the Application

LRA Section 3.6 provides AMR results for the electrical and I&C system components and component groups. LRA Table 3.6.1, "Summary of Aging Management Evaluations in Chapter VI of NUREG-1801 Electrical and Instrumentation and Controls Commodity Group," is a summary comparison of the applicant's AMRs with those evaluated in the GALL Report for the electrical and I&C system components and component groups.

The applicant's AMRs evaluated and incorporated applicable plant-specific and industry operating experience in the determination of AERMs. The plant-specific evaluation included condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.6.2 Staff Evaluation

The staff reviewed LRA Section 3.6 to determine whether the applicant provided sufficient information to demonstrate that the effects of aging for the electrical and I&C components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff 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 the SRP-LR Section 3.6.2.2 acceptance criteria. The staff's evaluations are documented in SER Section 3.6.2.2.

The staff's review of the electrical and I&C system component groups followed any one of several approaches. One approach, documented in SER Section 3.6.2.1, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and require no further evaluation. Another approach, documented in SER Section 3.6.2.2, reviewed AMR results for components that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in SER Section 3.6.2.3, reviewed AMR results for components that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs credited to manage or monitor aging effects of the electrical and I&C system components is documented in SER Section 3.0.3.

3.6.2.1 AMR Results Consistent with the GALL Report

LRA Section 3.6.2.1 identifies the materials, environments, AERMs, and the following programs that manage aging effects for the electrical and I&C system components:

- Electrical Cables and Connections Program
- Electrical Cables and Connections Used in Instrumentation Circuits Program
- Inaccessible Medium-Voltage Cables Program
- Metal-Enclosed Bus Program
- Fuse Holder Program
- Electrical Connections Program
- Electrical Penetration Assembly Program
- Structures Monitoring Program

In LRA Table 3.6.2-1, the applicant summarizes AMRs for the electrical and I&C 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 E indicating how the AMR is consistent with the GALL Report.

The staff reviewed the information in the LRA. The staff did not repeat its review of the matters described in the GALL Report, however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant: (a) provided a brief description of the system, components, materials, and environments; (b) stated that the applicable aging effects were reviewed and evaluated in the GALL Report; and (c) identified those aging effects for the electrical and I&C components that are subject to an AMR. On the basis of its review, the staff determines that, for AMRs not requiring further evaluation, as identified in LRA Table 3.6.1, the applicant's references to the GALL Report are acceptable and no further staff review is required.

The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's proposed AMPs. On the basis of its review, the staff concludes that the AMR results, which the applicant claimed to be consistent with the GALL Report, are indeed consistent with its AMRs. Therefore, the staff concludes that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.2 AMR Results Consistent with the GALL Report for Which Further Evaluation is Recommended

In LRA Section 3.6.2.2, the applicant further evaluates aging management, as recommended by the GALL Report, for the electrical and I&C components and provides information concerning how it will manage the following aging effects:

- electrical equipment subject to EQ
- degradation of insulator quality due to salt deposits or surface contamination, loss of material due to mechanical wear
- loss of material due to wind induced abrasion and fatigue, loss of conductor strength due to corrosion, and increased resistance of connection due to oxidation or loss of preload
- Quality Assurance for Aging Management of Nonsafety-Related Components

For component groups evaluated in the GALL Report, for which the applicant claimed consistency with the report and for which the GALL Report recommends further evaluation, the staff reviewed the corresponding AMR line items 3.6.1-11 and 3.6.1-12 in LRA Table 3.6.1. The staff also reviewed applicant's evaluation to determine whether it adequately addressed the issues further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in SRP-LR Section 3.6.2.2. The staff's review of the applicant's further evaluation follows.

3.6.2.2.1 Electrical Equipment Subject to Environmental Qualification

In LRA Section 4.4, the applicant provides an evaluation of EQ TLAAs. SER Section 4.4 documents the staff's review of the applicant's evaluation of this TLAA.

3.6.2.2.2 Degradation of Insulator Quality Due to Salt Deposits or Surface Contamination, Loss of Material Due to Mechanical Wear

LRA Section 3.6.2.2.2 addresses degradation of insulator quality due to salt deposits or surface contamination, and loss of material due to mechanical wear. The applicant stated that various airborne materials such as dust, salt, and industrial effluents can contaminate insulator surfaces. The buildup of surface contamination is gradual and in most areas such contamination is washed away by rain; the glazed insulator surface aids this contamination removal. A large buildup of contamination enables the conductor voltage to track along the surface more easily and can lead to insulator flashover. Surface contamination can be a problem in areas where there are greater concentrations of airborne particles such as near facilities that discharge soot or near the seacoast where salt spray is prevalent. The applicant also stated that it is located in an area with moderate rainfall and airborne particle concentrations are comparatively low. Consequently, the rate of contamination buildup on the insulators is not significant. The applicant stated that as in most areas of the power transmission system in this region, contamination build-up on insulators is not a problem. Therefore, the applicant concluded that surface contamination of the insulators is not considered a potential aging mechanism.

Regarding mechanical wear, the applicant stated that mechanical wear is an aging effect for strain and suspension insulators, in that they are subject to movement. Movement of insulators can be caused by wind blowing the transmission conductor, causing it to sway from side to side. If this swinging is frequent enough, it could cause wear in the metal contact points of the insulator string and between an insulator and the supporting hardware. Although this mechanism is possible, the applicant stated that experience has shown that the transmission conductors do not normally swing for very long, once the wind has subsided. The applicant also stated that generally, for distribution lines with average span lengths, Aeolian vibration damage will be eliminated if the design initial tensions at 60 °F (15 °C) are at or below 12 percent of the ultimate strength of the conductor. The applicant stated that there are two sets of cables and insulators that are subject to mechanical wear due to wind, 795 MCM 26/7 ACSR cable and the 3/8-inch EHS galvanized steel ground cable between the Switchyard and the Startup Transformer. The ultimate strength of the 795 MCM 26/7 ACSR cable is 31,500 pounds. The tension for the maximum span of 590 feet is 1,763 pounds or 5.6 percent of the ultimate strength. The ultimate strength of the 3/8-inch EHS galvanized steel ground cable is 15,400 pounds. The tension for the maximum span of 590 feet, is 966 pounds or 6.3 percent of the ultimate strength. The short cable runs are not susceptible to Aeolian vibration. Aeolian vibration only affects cables that are under tension greater than 15 percent of the rated strength. The cables listed below were not strung with any significant tension, so maximum tension that these cables could see is their own weight. For example, the 954 MCM AAC cable between the rigid bus and CB5560 has a weight of 896 pounds per 1,000 feet. and a rated strength of 16,400 pounds. For a 20 foot length of cable, the tension would be 17.92 pounds or about 0.1 percent of the rated strength. Therefore, the applicant concluded that loss of material due to wear is not an applicable aging effect for the insulators in the service conditions.

The staff reviewed LRA Section 3.6.2.2.2 against SRP-LR Section 3.6.2.2.2 which states that degradation of insulator quality due to salt deposits or surface contamination may occur in high-voltage insulators. The GALL Report recommends further evaluation of plant-specific AMPs for plants at locations of potential salt deposits or surface contamination (e.g., in the vicinity of salt water bodies, or industrial pollution). Loss of material due to mechanical wear caused by wind on transmission conductors may occur in high-voltage insulators. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed.

The applicant stated that it is located in an area with moderate rainfall and airborne particle concentrations are comparatively low and the rate of contamination buildup on the insulators is not significant. However, the applicant did not address plant-specific operating experience with high-voltage insulator failure due to surface contamination. In a letter dated November 13, 2009, the staff requested the applicant to review plant-specific operating experience to confirm that there were no incidences of high-voltage insulator failure due to surface contamination (RAI 3.6-1). In response to the staff request, in a letter dated December 14, 2009, the applicant stated that it has not experienced any failure of high-voltage insulators due to surface contamination. The staff finds the applicant response acceptable because it has independently reviewed the plant-specific operating experience and confirmed that there is no operating experience with high-voltage insulator failure due to surface contamination. The staff's concern about operating experience is resolved.

The staff determined that although loss of material of insulators due to mechanical wear is possible, transmission conductors do not normally swing and that when they do, due to a substantial wind, do not continue to swing very long once the wind has subsided. Wind loading that can cause a transmission line and insulators to vibrate or sway is typically considered in the design and installation. Furthermore, transmission conductors within the scope of license renewal are short spans (connecting the switchyard to the startup transformers) and the surface area exposed to wind loads is 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 programs identified 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, as required by 10 CFR 54.21(a)(3).

3.6.2.2.3 Loss of Material Due to Wind Induced Abrasion and Fatigue, Loss of Conductor Strength Due to Corrosion, and Increased Resistance of Connection Due to Oxidation or Loss of PreLoad

The staff reviewed LRA Section 3.6.2.2.3 against the criteria in SRP-LR Section 3.6.2.2.3.

LRA Section 3.6.2.2.3 addresses loss of material due to wind-induced abrasion and fatigue, loss of conductor strength due to corrosion, and increased resistance of connection due to oxidation or loss of preload. For wind-induced abrasion and fatigue, the applicant addressed this aging effect in LRA Section 3.6.2.2.2. For conductor corrosion, the applicant 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, degradation begins as a loss of Zn from the galvanized steel core wires. Corrosion rates depend largely on air quality, which includes suspended particles chemistry, sulfur dioxide (SO_2) concentration in air, precipitation, fog chemistry, and meteorological conditions.

The applicant also stated that tests performed by Ontario Hydroelectric showed a 30 percent loss of composite conductor strength of an 80-year-old ACSR conductor due to corrosion. There is a set percentage of composite conductor strength established at which a transmission conductor is replaced. 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 sets the maximum tension a conductor must be designed to withstand under heavy load requirements, which includes consideration of ice, wind, and temperature. The applicant reviewed these requirements concerning the specific conductors included in the AMR. The applicant stated that it will use the 795 thousands of circular mils (MCM) 26/7 (stranded 26 conductor, 7 steel core reinforced) ACSR between the switchyard and the startup transformer as an illustration. The ultimate strength and the NESC heavy load tension requirements of 795 MCM 26/7 ACSR are 31,500 pounds and 4,160 pounds respectively. The applicant stated that margin between the NESC Heavy Load and the ultimate strength is 27,340 pounds (i.e., there is an 86.8 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 795 MCM 26/7 ACSR transmission conductors, a 30 percent loss of ultimate strength would mean that there would still be a 56.8 percent ultimate strength margin between what is required by the NESC and the actual conductor strength. The applicant also stated that the 795 MCM 26/7 ACSR conductors is the most risk significant of any transmission conductors included in the scope of this AMR. This illustrates with reasonable assurance that transmission conductors will have ample strength through the period of extended operation. The applicant further stated that corrosion of ACSR conductors is a very slow acting aging effect that is even slower for rural areas with generally less suspended particles and SO_2 concentrations in the air than urban areas. Based on the Ontario Hydroelectric study and the fact that it is in a rural area, the applicant concluded that there are no applicable aging effects due to corrosion that could cause loss of the intended function of the transmission conductors for the period of extended operation.

With respect to aging effect of increased resistance of electrical connections, the applicant stated that conductor connections are generally of the compression bolted category. No organic materials are involved. Connection materials exposed to the service conditions of the switchyard do not experience any appreciable aging effects, except for minor oxidation, which does not impact the ability of the conductor connection to perform its intended function. The applicant also stated that based on operating experience, this method of installation has been shown to provide a low electrical resistance connection. The only bolted connections associated with transmission conductors are switchyard bus connections, other switchyard components (breakers and current transformers) connections and transformers connections. The bolting hardware used for these connections was selected to be compatible with the aluminum connector and conductor coefficient of thermal expansion. This ensures that the contact pressure of the bolt and washer combination used in the connector is maintained to the initial vendor specified torque value. The applicant further stated that its design incorporates the use of stainless steel Belleville washers on the bolted electrical connections to compensate for temperature changes, maintain the proper torque, and prevent loosening of dissimilar metal connection hardware. This method of assembly is consistent with the good bolting practices. In addition, the applicant stated that industry experience has shown that hydrogen embrittlement could be a problem with Belleville washers and other springs. When springs are electroplated, the plating process forces hydrogen into the metal grain boundaries. If the hydrogen is not removed, the spring may spontaneously fail at any time while in service. Although hydrogen embrittlement occurs infrequently, it is not recommended that electroplated Belleville washers and other springs be used. The applicant also stated that plant drawings indicate that the Belleville washers used for transmission conductor and switchyard bus connections are stainless steel, but do not indicate if they are electroplated. The applicant stated that connection materials exposed to the service conditions of the switchyard may experience minor oxidation resulting in increased resistance across the electrical connection and Belleville washers may fail due to hydrogen embrittlement. To provide reasonable assurance that the electrical continuity function of the connection is maintained, the applicant will include these connections in the Electrical Connections Program.

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 preload 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 addressed loss of material due to wind induced abrasion and fatigue in SER Section 3.6.2.2.2.

The staff reviewed the testing program performed by Ontario Hydroelectric to determine whether Duane Arnold transmission conductors have adequate design margin to perform their intended function during extended period of operation. The study showed about 30 percent loss of conductor strength of an 80 year old ACSR conductor 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 includes consideration of ½ inch of radial ice and 4 pounds per square feet (psf) wind. The staff reviewed the requirements concerning the specific conductors included in the AMR. The applicant used a most limiting 795 MCM 26/7 ACSR transmission conductor in the switchyard to illustrate how the transmission conductor aging due to corrosion is insignificant. The ultimate strength of a 795 MCM 24/7 strand ACSR conductor is 31,500 pounds. and the maximum design tension for this conductor is 4,160 pounds. A 30 percent loss of transmission conductor strength after 80 years in service would mean that the conductor strength would be 22,050 pounds (31,500 lbs. x 0.7). The ratio between the heavy loading and the ultimate conductor strength would be approximately 19 percent (4160 lbs/22050 lbs). The NESC requires that tension on installed conductor be a maximum of 60 percent of the ultimate conductor strength. The tension (i.e., heavy load) of a typical transmission conductor as illustrated by the applicant would not exceed the NESC maximum requirement of 60 percent of the ultimate conductor strength. Furthermore, 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 an 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 the Ontario Hydro test program bounds the trasmission conductors at Duane Arnold and loss of conductor strength is not a significant aging effect requiring management for the period of extended operation. The staff also determined that with a 30 percent loss of conductor strength, there is still ample margin between the NESC requirements and the actual conductor strength.

The staff noted that the design of the switchyard bolted connections typically precludes torque relaxation. The type of bolting plates and the use of Belleville washers is the industry standard to preclude torque relaxation. 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"). However, EPRI TR-104213 states that hydrogen embrittlement could be a problem with Belleville washers and other springs. When springs are electroplated, the plating process forces hydrogen into the metal grain boundaries. If the hydrogen is not removed, the spring may spontaneously fail at any time while in service. Although hydrogen embrittlement occurs infrequently, it is not recommended that electroplated Belleville washers and other springs be used. Increased resistance of connection due to oxidation could occur in transmission conductor connections and switchyard connections. To address hydrogen embrittlement in Belleville washer and minor oxidation that could result in increased resistance of transmission conductor and switchyard bus connections, the applicant will include these connections in the Electrical Connections Program. The staff evaluation of this AMP is in SER Section 3.0.3.3.1.

Based on the programs identified 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, as required by 10 CFR 54.21(a)(3).

3.6.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 documents the staff's evaluation of the applicant's QA program.

3.6.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

In LRA Table 3.6-1 through 3.6-2, the staff reviewed additional details of the AMR results for material, environment, AERM, and AMP combinations not consistent with or not addressed in the GALL Report.

In LRA Table 3.6-1 through 3.6-2, the applicant indicated, via Note J, that the combination of component type, material, environment, and AERM does not correspond to a line item in the GALL Report. The applicant provided further information about how it will manage the aging effects.

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 section.

3.6.2.3.1 Aging Management Review Results – Electrical and I&C Components – LRA Table 3.6.2-1

In LRA Table 3.6-2 under the electrical penetration assemblies item, the applicant included note J and footnote 604. In footnote 604, the applicant stated that it has identified an AERM for electrical penetration assemblies (EPAs) that are not included in the EQ program. The applicant also stated that moisture has degraded the epoxy insulation between conductors. The applicant further stated that this aging effect is managed by maintaining the EPA at a positive pressure.

The staff noted that moisture intrusion could degrade the insulation resistance of the epoxy in the EPA. The applicant has experienced the failure of two EPAs and has performed an analysis of one EPA. The applicant concluded that the failure was due to moisture, a random void, and a potential difference between conductors with subsequent growth of dendrites between the conductors. The dendrites form a low resistance path, over a long period of time, for current leakage, arcing, and carbonization of the epoxy. The electrical short finally developed when the carbonized path between the conductors became continuous and resulted in shorting between the splices of the two conductors. The moisture could have been due to less than adequate adherence to manufacturer instruction which required that internal nitrogen pressure be maintained in the assemblies. Dendrite formation requires the presence of moisture. The applicant proposed the Electrical Penetration Assemblies Program to manage the aging effect of moisture. The staff finds this program acceptable to manage the aging effect of EPAs. The staff's evaluation of this program is in SER Section 3.0.3.3.2.

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).

3.6.3 Conclusion

The staff concludes that the applicant has provided sufficient information to demonstrate that the effects of aging for the electrical and I&C system components within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.7 Conclusion for Aging Management Review Results

The staff reviewed the information in LRA Section 3, "Aging Management Review Results," and LRA Appendix B, "Aging Management Programs." On the basis of its review of the AMR results and AMPs, the staff concludes that the applicant has demonstrated that the aging effects will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the applicable UFSAR supplement program summaries and concludes that the supplement adequately describes the AMPs credited for managing aging, as required by 10 CFR 54.21(d).

With regard to these matters, the staff concludes that there is reasonable assurance that the applicant will continue to conduct the activities authorized by the renewed licenses will continue to be conducted in accordance with the CLB, and any changes made to the CLB, in order to comply with 10 CFR 54.21(a)(3), are in accordance with the Atomic Energy Act of 1954, as amended, and NRC regulations

SECTION 4

TIME-LIMITED AGING ANALYSES

4.1 Identification of Time-Limited Aging Analyses

This section of the safety evaluation report (SER) addresses the identification of time-limited aging analyses (TLAAs). In license renewal application (LRA) Sections 4.2 through 4.7, Florida Power and Light Energy Duane Arnold, LLC (FPL-DA or the applicant) addressed the TLAAs for Duane Arnold Energy Center (DAEC). SER Sections 4.2 through 4.8 document the review of the TLAAs conducted by the staff of the United States (U.S.) Nuclear Regulatory Commission (NRC) (the staff).

TLAAs are certain plant-specific safety analyses that involve time-limited assumptions defined by the current operating term. Pursuant to Title 10, Section 54.21(c)(1), of the *Code of Federal Regulations* (10 CFR 54.21(c)(1)), applicants must list TLAAs as defined in 10 CFR 54.3.

In addition, pursuant to 10 CFR 54.21(c)(2), applicants must list plant-specific exemptions granted under 10 CFR 50.12 based on TLAAs. For any such exemptions, the applicant must evaluate and justify the continuation of the exemptions for the period of extended operation.

4.1.1 Summary of Technical Information in the Application

To identify the TLAAs, the applicant evaluated analyses for DAEC against the six criteria specified in 10 CFR 54.3. The applicant indicated that it has identified the analyses that meet the six criteria by searching the current licensing basis (CLB) documentation. The CLB reviewed includes the updated final safety analysis report (UFSAR), technical specifications (TSs), technical requirements manual, docketed correspondence, NRC SERs, fire protection program documents, design calculations and reports, and applicable NUREGS and industry reports, including the guidance in Nuclear Energy Institute (NEI) 95-10, “Industry Guidelines for Implementing the Requirements of 10 CFR 54 – The License Renewal Rule.” In LRA Table 4.1-1,“Time-Limited Aging Analyses,” the applicant listed the applicable DAEC TLAAs that meet all six criteria in the following categories:

- neutron embrittlement of the reactor pressure vessel (RPV) and internals
- metal fatigue
- environmental qualification (EQ)
- concrete containment tendon
- fatigue of primary containment, piping, and components
- other plant-specific TLAA

Pursuant to 10 CFR 54.21(c), the applicant stated in LRA Section 4.1.3 that it had reviewed the NRC correspondence and other DAEC CLB documentation, identified in LRA Section 4.1.1, for exemptions. The applicant 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 TLAA's the applicant identified as being applicable to DAEC. The staff reviewed the information to determine whether the applicant had provided sufficient information pursuant to 10 CFR 54.21(c)(1) and 10 CFR 54.21(c)(2). As defined in 10 CFR 54.3, TLAA's meet the following six criteria:

(1) involve systems, structures, and components (SSCs) within the scope of license renewal, as described in 10 CFR 54.4(a)

(2) consider the effects of aging

(3) involve time-limited assumptions defined by the current operating term (40 years)

(4) are determined to be relevant by the applicant in making a safety determination

(5) involve conclusions, or provide the basis for conclusions, related to the capability of the SSC to perform its intended functions, as described in 10 CFR 54.4(b)

(6) are contained or incorporated by reference in the CLB

As required by 10 CFR 54.21(c)(2), the applicant must list all exemptions granted in accordance with 10 CFR 50.12, based on TLAAs, and evaluated and justified for continuation through the period of extended operation. The LRA states that the DAEC docketed NRC correspondence and other DAEC CLB documentation was reviewed for exemptions, and that no exemptions were identified that meet the definition of a TLAA as defined by 10 CFR 54.3. The staff reviewed selected documentation regarding the TLAA and exemption processes and identified no cases where the applicant omitted TLAAs or exemptions inappropriately.

4.1.3 Conclusion

On the basis of its review, the staff concludes that the applicant has provided an acceptable list of TLAAs, as required by 10 CFR 54.21(c)(1), and that no exemption has been granted on the basis of a TLAA for which continuation has been justified during the period of extended operation as specified in 10 CFR 54.21(c)(2).

4.2 Reactor Vessel Neutron Embrittlement

"Neutron embrittlement" is the term for changes in mechanical properties of reactor vessel materials caused by exposure to fast neutron flux (E greater than 1.0 million electron volts (MeV)) within the vicinity of the reactor core, called the beltline region. The most pronounced material change is a reduction in fracture toughness. As fracture toughness decreases with cumulative fast neutron exposure, the material's resistance to crack propagation decreases. Fracture toughness also depends on temperature. The reference nil-ductility temperature (RT_{NDT}), above which the material behaves in a ductile manner and below which the material behaves in a brittle manner, increases as fluence increases and requires higher temperatures for continued ductility. In 10 CFR Part 50, the regulations governing reactor vessel integrity, Section 50.60, requires all light-water reactors to meet the fracture toughness, pressure-temperature (P-T) limits, and material surveillance program requirements for the reactor coolant pressure boundary (RCPB) in Appendices G and H of 10 CFR Part 50. The CLB analyses evaluating reduction of fracture toughness of the RPV for 40 years are TLAAs. Neutron fluence, upper-shelf energy (USE), adjusted reference temperature (ART), and vessel P-T limits are time-dependent items that must be investigated to evaluate vessel embrittlement (i.e., fracture toughness of vessel materials). The following sections address fluence, USE, ART, P-T limits, circumferential welds, and axial welds for RPV beltline materials for the period of extended operation.

<u>Summary of Technical Information in the Application</u>. Regarding reactor pressure vessel (RPV) neutron fluence, the applicant stated the following (Reference 1, Page 4.2-1):

> To evaluate the effects of radiation on RPV material embrittlement, analyses were performed to determine neutron fluence for extended operation. Using actual reactor core power histories to-date and conservative estimates of future core designs, extended operation to 60 years will be bounded by 54 EFPY (90 percent capacity factor times 60 years). High energy (>1 MeV) neutron fluence for the welds and shells of the RPV beltline region was calculated using the RAMA fluence methodology…Use of this methodology for evaluations of fluence for the DAEC was performed in accordance with guidelines presented in Regulatory Guide 1.190, as recommended in NUREG-1800, Section 4.

<u>Staff Evaluation</u>. The 60-year fluence value was calculated using the RAMA methodology (References 4-6). The staff reviewed the applicant's conservative calculations of average capacity factor of 90 percent for 60 years and agrees that it is not mathematically possible to reach a lifetime average of 90 percent due to much lower capacity factors early in plant life. RAMA has been generically approved by the staff on the basis that its calculational approach follows the guidance set forth in RG 1.190; namely, it uses a fully three dimensional representation of the core neutron source, it uses ENDF/B-VI-based nuclear data contained in the BUGLE-96 cross section library, and it employs an anisotropic scattering representation based on P_3 Legendre expansion. The fluence calculation is, therefore, acceptable because the applicant has used an NRC-approved method that employs a calculational approach found to be consistent with the recommendations set forth in RG 1.190.

In its previous review and evaluation of the RAMA methodology, the staff issued two qualifying conditions on the use of RAMA for plant-specific applications (Reference 7). The staff's original approval of RAMA was based on both the generic qualification recommendations set forth in Regulatory Guide (RG) 1.190 (i.e., H.B. Robinson Unit 2 qualification, Oak Ridge National Laboratory Pool Critical Assembly, etc.), and on plant-specific comparisons using reactor dosimetry qualification from Susquehanna Steam Electric Station Unit 2 and Hope Creek Generating Station, where the plant-specific calculations were found to be in close agreement with measured data. The conditions on the use of RAMA restrict the applicability of RAMA, without plant-specific qualification data, to only BWRs of similar geometry to Hope Creek and Susquehanna. Since DAEC is a BWR/4, like Hope Creek and Susquehanna, such restrictions do not apply.

The NRC staff concludes that the use of RAMA for reactor vessel fluence calculations at DAEC is acceptable because the RAMA methodology adheres to the guidance set forth in RG 1.190 for both calculational approach and benchmarking specific to DAEC's reactor vessel geometry.

As indicated by the applicant, the end-of extended license irradiation in effective full power years (EFPY) is estimated to be bounded by the 54 EFPY for which the analysis was performed. The staff finds the enveloping nature of a 54 EFPY calculation acceptably conservative.

Conclusion. The staff finds that the calculation was 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.

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that, for reactor vessel neutron fluence, the analyses have been projected to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.1 Reactor Vessel Upper Shelf Energy Reduction

4.2.1.1 Summary of Technical Information in the Application

In LRA Section 4.2.1, the applicant summarized the evaluation of RPV materials USE reduction due to neutron embrittlement for the period of extended operation. USE is the standard industry parameter used to indicate the maximum toughness of a material at high temperature. Appendix G of 10 CFR Part 50 requires the predicted end of life (EOL) Charpy impact test USE for RPV materials to be at least 50 ft-lb (absorbed energy), unless an approved analysis supports a lower value. The predicted USE drop is determined in accordance with RG 1.99, Revision 2, “Radiation Embrittlement of RPV Materials.”

The applicant stated that peak fluence was calculated at the RPV inner surface (inner diameter) for the purpose of evaluating the USE. The value of neutron fluence was also calculated for the 1/4T (T is the RPV wall thickness) location into the RPV wall base material, measured radially from the inside diameter (ID) at the clad-base metal interface, using equation 3 from paragraph 1.1 of RG 1.99, Revision 2. This 1/4T depth is specified in American Society of Mechanical Engineers (ASME) Code, Section XI, Appendix G, 1998 Edition through 2000 Addenda, Article G-2120, as the maximum postulated defect depth.

The 54-year USE was evaluated by an equivalent margins analysis (EMA) using the 54 EFPY calculated fluence and surveillance capsule results. Credible data are available for only one surveillance plate (B0673-1). Electric Power Research Institute (EPRI) TR-113596, “BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines,” dated September 1999, (also referred to as the Boiling Water Reactor Vessel and Internals Project (BWRVIP) 74-A report), performed a generic analysis and determined that the allowable percent reductions in Charpy USE for the limiting BWR/3-6 plates and BWR-2 through BWR-6 welds are 23.5 percent and 39 percent, respectively. LRA Tables 4.2.1-2 through 4.2.1-12 provide the results of the EMA for the limiting welds and plates in the RPV. The applicant stated that the results demonstrated that the percent USE reduction for the RPV materials is bounded by the EMA per BWRVIP-74-A in all cases and the results comply with the provisions of 10 CFR Part 54.21(c)(1)(ii).

4.2.1.2 Staff Evaluation

Section IV.A.1.a of 10 CFR Part 50, Appendix G, requires, in part, that the RPV beltline materials have Charpy USE values in the transverse direction for base metal and along the weld for weld material of no less than 50 ft-lb, unless it is demonstrated, in a manner approved by the staff, that lower values of Charpy USE will ensure margins of safety against fracture equivalent to those required by ASME Code Section XI, Appendix G.

By letter dated April 30, 1993, the Boiling Water Reactor Owners Group (BWROG) submitted topical report NEDO-32205-A, "10 CFR 50 Appendix G Equivalent Margin Analysis for Low Upper Shelf Energy in BWR/2 through BWR/6 Vessels," to demonstrate that boiling water reactor (BWR) RPVs could meet margins of safety against fracture equivalent to those required by ASME Code Section XI, Appendix G for Charpy USE values less than 50 ft-lb. In a letter dated December 8, 1993, the staff concluded, in accordance with 10 CFR Part 50, Appendix G, that the topical report demonstrated that the evaluated materials have the margins of safety against fracture equivalent to ASME Code Section XI, Appendix G. Subsequently, General Electric (GE) performed an update to the USE EMA in the BWRVIP-74-A report, which the staff reviewed and approved by letter dated October 18, 2001. The analysis in the BWRVIP-74-A report determined the reduction in the Charpy USE resulting from neutron irradiation using the methodology in RG 1.99, Revision 2. Using a correction factor of 65 percent for conversion of the longitudinal properties to transverse properties, the lowest Charpy USE at 54 EFPY of facility operation for all BWR/3-6 plates was projected to be 45 ft-lb. The correction factor was chosen based on NRC Branch Technical Position (BTP) MTEB 5-2. The resulting acceptance criteria that are specified in the BWRVIP-74-A report indicate that the maximum allowable percentage reduction in USE value is 23.5 percent for the BWR/3-6 plates and 39 percent for the BWR-2 through BWR-6 welds.

Since the analysis in the BWRVIP-74-A report is a generic analysis, the applicant submitted plant-specific information in LRA Tables 4.2.1-2 through 4.2.1-12 to demonstrate that the limiting beltline materials for the RPV will meet the criteria in the BWRVIP-74-A report at the end of the period of extended operation (54 EFPY).

In LRA Section 4.2.5, the applicant stated that the neutron fluence values at nozzles N-2 and N-16 exceed 1 x 10^{17} neutrons per square centimeter (n/cm^2) (E greater than 1 MeV). The Generic Aging Lessons Learned (GALL) Report Table IV.A1, item IV.A1-4, paragraph (c) of the aging management program (AMP) column requires an evaluation of USE or an EMA be performed as part of TLAA for ferritic materials that are exposed to a neutron fluence value greater than 1 x 10^{17} n/cm^2 (E greater than 1 MeV). Therefore, by letter dated October 16, 2009, the staff issued RAI 4.2.8-1 requesting that the applicant provide USE values for these nozzles and their associated welds. The staff requested that the applicant provide one of the following: (1) if the initial USE values are available, the percent USE reduction for nozzle and the welds per the requirements specified in RG 1.99, Revision 2, or (2) if the initial USE values for N-2 and N-16 nozzle materials and the associated welds are not available, an EMA per the BWRVIP-74-A report.

In its response dated November 16, 2009, the applicant stated that the initial USE values were not available for N-2 and N-16 nozzles and the associated welds and, therefore, the applicant performed an EMA for the nozzles and the welds as part of its submittal. The staff reviewed the results and find them acceptable because the percent reduction in USE of the N-2 and N-16 nozzles and the associated welds at DAEC is less than the acceptance criteria specified in BWRVIP-74-A.

The staff confirmed the reduction in the unirradiated USE values resulting from neutron radiation using the methodology in RG 1.99, Revision 2. The information provided in the LRA demonstrates that the percent reduction in USE for the limiting RPV beltline materials at DAEC is less than the acceptance criteria specified in BWRVIP-74-A. The staff also reviewed the applicant's plant-specific calculation values for the percentage reduction in USE at the end of the period of extended operation for all the plates, nozzles, and weld metals in the beltline region of the RPV, and determined that the percent reduction in USE for all the RPV beltline materials is less than the acceptance criteria specified in BWRVIP-74-A.

4.2.1.3 UFSAR Supplement

In LRA Section 18.3.1.2, the applicant provided a UFSAR supplement summary description of its TLAA evaluation of USE reduction due to neutron embrittlement in RPV beltline materials. On the basis of its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address RPV materials USE reduction due to neutron embrittlement is adequate.

4.2.1.4 Conclusion

On the basis of its review and the RAI response, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that, for the RPV materials USE reduction due to neutron embrittlement TLAA, the analyses have been projected to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the activities for managing the effects of aging and the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.2 Adjusted Reference Temperature Increase

4.2.2.1 Summary of Technical Information in the Application

In LRA Section 4.2.2, the applicant summarized the ART determination of the limiting vessel beltline material due to neutron embrittlement. The ART of the limiting beltline material is used to adjust the beltline P-T curves to account for irradiation effects. The ART is defined as the sum of the initial (non-irradiated) RT_{NDT}, the mean value of the adjustment in RT_{NDT} caused by irradiation (ΔRT_{NDT}), and a margin (m) term. The margin is defined in RG 1.99, Revision 2, and the P-T curves are developed from the limiting ART values for the vessel materials. As addressed in RG 1.99, Revision 2, ΔRT_{NDT} is a function of neutron fluence. Since neutron fluence changes with time, the determination of ΔRT_{NDT} (and, therefore, ART) meets the criteria of 10 CFR 54.3(a) for being a TLAA.

Peak fluences were calculated at the vessel inner surface (inner diameter) for the purpose of evaluating the USE and ART values. The inside surface fluences were considered to be at the base metal/cladding interface. The neutron fluence values were also calculated for the 1/4T location in the vessel wall, measured radially from the ID using equation 3 from paragraph 1.1 of RG 1.99, Revision 2. This 1/4T depth is given in ASME Code Section XI, Appendix G, Subarticle G-2120 as the maximum postulated defect depth. The applicant calculated ART values for the RPV beltline materials based on the embrittlement correlation found in RG 1.99, Revision 2. LRA Table 4.2.3-1 presents the peak fluence and ART values for the 60-year licensed operating period (54 EFPY). The applicant stated that the ART value of the limiting beltline material at 54 EFPY is below 200 °F and this value is consistent with that of the suggested value in RG 1.99, Revision 2 and, therefore, it is acceptable.

4.2.2.2 Staff Evaluation

LRA Table 4.2.2-1 shows the bounding fluence values of the beltline materials for the period of extended operation (54 EFPY). In reviewing the chemistry data (percent copper and percent nickel) and chemistry factor values for the plates in shell ring #2 Piece 1-21, provided by the applicant in LRA Table 4.2.3-1, the staff noted that the percent nickel and chemistry factor values were more conservative than the corresponding chemistry data and chemistry factor values that were established in the staff's Reactor Vessel Integrity Database for these welds (0.65 vs. 0.61 wt% Ni).

In LRA Table 4.2.2-1, the applicant listed ART values for nozzles N-2 and N-16, and nozzle N-16 had the highest ART value. LRA Table 4.2.3-1, however, does not list the ART values for N-2 and N-16 nozzle welds. Therefore, by letter dated October 16, 2009, the staff issued RAI 4.2.8-2 requesting that the applicant submit the following information: (1) weld metal chemistry, (2) American Welding Society (AWS) weld electrode/filler wire classification and the heat/lot number, (3) initial (un-irradiated) RT_{NDT} of the weld materials, (4) 1/4T neutron fluence value of the nozzle welds at 54 EFPY, and (5) ART values for the nozzle weld materials. This information would be used to evaluate whether the nozzle N-2 and N-16 welds would have adequate toughness until the end of the extended period of operation.

In its response dated November 16, 2009, the applicant provided the ART values for N-2 and N-16 nozzle welds and their ART values were bounded by the ART value of N-16 nozzle material. The staff reviewed the response and determined that since the test materials used in the BWR Integrated Surveillance Program (ISP) do not have heat-to-heat match with the nozzle base materials, the staff used chemistry values for copper and nickel listed in Table 1 and 2 of RG 1.99, Revision 2. These values are used for determining the chemistry factor which is used for the ART calculations.

The staff independently reviewed all ART calculations in LRA Table 4.2.2-1 based on the chemistry and fluence data and determined that the applicant appropriately followed the guidance of RG 1.99, Revision 2 in determining the ART values for the RPV beltline materials. Therefore, the staff finds these values acceptable.

4.2.2.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of ART for RPV materials due to neutron embrittlement in LRA Section 18.3.1.2. On the basis of its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address ART for RPV materials due to neutron embrittlement is adequate.

4.2.2.4 Conclusion

On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that, for the ART for the RPV materials due to neutron embrittlement TLAA, the analyses have been projected to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the activities for managing the effects of aging and the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.3 Reactor Vessel Thermal Limit – Operating Pressure-Temperature Limits

4.2.3.1 Summary of Technical Information in the Application

In LRA Section 4.2.3, the applicant summarized the evaluation of RPV thermal limit analyses and associated operating P-T limits for the period of extended operation. The ART is a key material property for developing operating P-T limits and is used to establish the minimum temperature at which the RPV can be pressurized. As defined previously, ART is the sum of the initial RT_{NDT}, ΔRT_{NDT}, and margin (m) for uncertainties at a specific RPV location and material. Neutron embrittlement increases the ART, therefore, the minimum temperature at which the RPV can be pressurized increases with increased fluence. The ART of the limiting beltline material is used to adjust the beltline P-T limits to account for irradiation effects. Appendix G to 10 CFR Part 50 requires RPV thermal limit analyses to determine operating P-T limits for boltup, hydro-test, pressure tests, and normal operating and anticipated operational occurrences.

The applicant stated that the DAEC TSs contain P-T limit curves for heatup and cooldown operations, and inservice leakage and hydrostatic testing. According to the applicant, limits are also imposed on the maximum rate of change of reactor coolant temperature. The TSs P-T limit curves are calculated for the current 32 EFPY operating period. The applicant stated that new P-T limit curves have been created for 54 EFPY of operation using the methodology of the 2001 Edition, 2003 Addenda of ASME Code Section XI, Appendix G, and 10 CFR Part 50, Appendix G. The curves were developed in accordance with the methodology of the BWROG Licensing Topical Report, “Pressure Temperature Limits Report Methodology for Boiling Water Reactors,” and Structural Integrity Associates Report No. SIR-05-044-A, Revision 0, “Pressure-Temperature Limits Report Methodology for Boiling Water Reactors,” April 2007. The full set of P-T curves evaluation was done for all DAEC RPV regions, which are consolidated into three evaluated regions: (1) the beltline, (2) the bottom head, and (3) the feedwater nozzle/upper vessel.

The applicant identified that two nozzles, N-2 and N-16, located in the beltline region will become exposed to a neutron fluence value greater than 1×10^{17} n/cm^2 (E greater than 1 MeV) during the period of extended operation. The applicant stated that it developed two P-T curves: (1) a P-T curve for the limiting beltline plate location using the highest plate ART and no stress concentration effect and (2) a P-T curve for the limiting nozzle with stress concentration effects. The limiting nozzle is determined by evaluating the nozzle’s ART value and the thermal transient loads. Nozzle N-16 has the highest ART value but does not have any significant thermal loading. However, the N-2 nozzle is exposed to significant thermal loads and, therefore, it is considered the limiting nozzle. The applicant used finite element analysis (FEM) for the feedwater nozzle and intends to apply a similar analysis to the N-2 nozzle. Since these nozzles are not identical, the applicant intends to apply this FEM analysis taking into account conservative scaling factors due to the differences between these nozzles. The applicant concluded that it will project the analysis related to the development of P-T curves through the period of extended operation under the provisions allowed in 10 CFR 54.21(c)(1)(ii).

4.2.3.2 Staff Evaluation

Appendix G of 10 CFR Part 50 requires that the RPV be maintained within established P-T limits including during any condition of normal operation. This includes heatup and cooldown and these limits specify the maximum allowable pressure as a function of reactor coolant temperature. As the RPV becomes embrittled and its fracture toughness is reduced, the allowable pressure (given the required minimum temperature) is reduced.

By letter dated August 6, 2003, the staff accepted the applicant's request to modify the DAEC TSs to include the RPV P-T limits valid through 32 EFPY, meeting the requirements in ASME Code Section XI, Appendix G as modified by ASME Code Case N-640, and 10 CFR Part 50, Appendix G. Because the staff does not require the P-T limit curves for the period of extended operation to be submitted as part of the applicant's LRA for this TLAA, by letter dated September 24, 2009, the staff issued RAI 4.2.3-1 to request that the applicant submit P-T limit curves for the period of extended operation prior to the expiration of the facility's current P-T limit curves for 32 EFPY. The staff also requested that the applicant provide information regarding the future submittal of the P-T limit curves for the staff approval for the period of extended operation (54 EFPY).

In its response dated October 23, 2009, the applicant stated that the changes in P-T limits will be managed by using surveillance capsule results and the neutron fluence values applicable for the end of the period of extended operation. A change in P-T limits will be implemented by the license amendment process under the provisions of 10 CFR 50.60 and 10 CFR Part 50, Appendix G. The staff finds the applicant's statement to manage the P-T limits acceptable because the change in P-T limits will be implemented by the license amendment process (i.e., modifications of TSs) which meets the regulatory requirements of 10 CFR 50.90, 10 CFR 50.60, and 10 CFR Part 50, Appendix G.

The applicant identified that two nozzles, N-2 and N-16, located in the beltline region will become exposed to a neutron fluence value greater than 1×10^{17} n/cm^2 (E greater than 1 MeV) during the period of extended operation. The applicant identified that nozzle N-16 has the highest ART value but does not have any significant thermal transient loading and, therefore, the stress concentration effects are not significant. The N-2 nozzle on the other hand is exposed to more significant thermal loads than the N-16 nozzle but has a 42 °F lower ART value. The applicant determined that the N-2 nozzle is more limiting because of its exposure to higher stresses due to thermal transients. Since there is a significant difference in ART values between the N-2 and N-16 nozzles, the staff expects the applicant to submit updated P-T curves which will include an explanation for selecting the N-2 nozzle as the more limiting material. Based on the review, the staff determined that the applicant recognizes the complexities of stress distributions that are inherently associated with nozzles, and it has adequately addressed these issues in the LRA.

The applicant stated that it will develop two P-T curves: (1) a P-T curve for the limiting beltline plate location using the highest plate ART and no stress concentration effect, and (2) a P-T curve for the limiting nozzle with stress concentration effects. The staff accepts the applicant's approach to use two P-T curves. The staff expects the applicant to use the most conservative of the two P-T curves during the period of extended operation. The staff also expects that the P-T curves that will be developed by the applicant with the N-2 nozzle as a limiting beltline material will include a methodology that takes into account the complex stresses which depend on the type (i.e., cylindrical geometry or a typical nozzle) and the size of the nozzle.

The staff accepts the applicant's approach of updating the P-T limit curves for DAEC as required by Appendix G of 10 CFR Part 50. Also, these required updates of the P-T limit curves will be adequately managed for the period of extended operation by the RPV surveillance program. The applicant shall submit the updated P-T curves (when developed) to the staff for review and approval in accordance with 10 CFR 50.90. Since the applicant has not submitted updated P-T limit curves for the period of extended operation, the staff determined that the TLAA for the P-T curves will be managed under the provisions of 10 CFR 54.21 (c)(1)(iii) and not per 10 CFR 54.21 (c)(1)(ii) as dispositioned by the applicant.

4.2.3.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of RPV operating P-T limits in LRA Section 18.3.1.3. On the basis of its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address RPV operating P-T limits is adequate.

4.2.3.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that, for the RPV operating P-T limits TLAA, the analyses will be adequately managed to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the activities for managing the effects of aging and the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.4 Reactor Vessel Circumferential Weld Examination Relief

4.2.4.1 Summary of Technical Information in the Application

For the case of RPV circumferential welds, ASME Code Section XI governs inspection of these welds, including inspection at regular intervals as described in ASME Code Section XI, Table IWB-2500-1. By letter dated January 5, 2005, DAEC received inspection relief for the circumferential welds for the time remaining in the 40-year licensed operating period. This inspection relief is based upon NRC Generic Letter (GL) 98-05, "Boiling Water Reactor Licensees use of the BWRVIP-05 Report to Request Relief from Augmented Examination Requirements on Reactor Pressure Vessel Circumferential Shell Welds." Relief from RPV circumferential weld examination requirements under GL 98-05 is based on probabilistic assessments that predict an acceptably low probability of failure (PoF) per reactor operating year. The analysis was based on RPV metallurgical conditions as well as flaw indication sizes and frequencies of occurrence that are expected at the end of a licensed operating period. The basis for the applicant's relief request was an analysis that satisfied the limiting conditional failure probability for the circumferential welds at the expiration of the current license, based on the BWRVIP-05 report, "BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations," and the extent of neutron embrittlement. The applicant recognizes that the anticipated changes in metallurgical conditions expected over the period of extended operation require an additional analysis for 54 EFPY (corresponding to 60 years) to be reviewed and approved by the staff.

The applicant estimated the PoF due to a limiting event (i.e., low temperature overpressure protection (LTOP)) for the RPV beltline circumferential welds. The PoF results were calculated for 60 years (54 EFPY) for the RPV beltline circumferential weld, including the consideration of the LTOP occurrence probability. The PoF value for the beltline circumferential weld due to an LTOP event is less than the value specified in the staff's safety evaluation (SE) for the BWRVIP-05 Report dated July 1998. The applicant stated that the PoF results justify the elimination of the RPV circumferential weld examination in the vessel beltline region to the end of the period of extended operation (60 years or 54 EFPY) for the DAEC.

The applicant stated that the procedures and training used to limit RPV cold overpressure events will be the same as those approved by the staff for DAEC in implementing the BWRVIP-05 technical alternative for the term of the current operating license. The applicant stated that a request for an extension of the inspection relief through 54 EFPY will be submitted to the staff prior to the period of extended operation.

The applicant concluded that its TLAA evaluation is projected through the period of extended operation and is consistent with the requirements of 10 CFR 54.21(c)(1)(ii).

4.2.4.2 Staff Evaluation

The staff reviewed LRA Section 4.2.4 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 technical basis for relief from the ASME Code Section XI, inservice inspection (ISI) requirements is discussed in the staff's final SE concerning the BWRVIP-05 report dated July 28, 1998. The staff's SE letter indicated that BWR applicants may request relief from the ISI requirements of 10 CFR 50.55a(g) for volumetric examination of circumferential RPV welds by demonstrating that: (1) at the expiration of the license, the circumferential welds satisfy the limiting conditional failure probability for circumferential welds in the staff's evaluation dated July 28, 1998, and (2) the applicant implemented operator training and established procedures that limit the frequency of cold overpressure events to the frequency specified in the staff's SE. The letter indicated that as part of any BWR LRA, the requirements for the inspection of RPV circumferential welds during an additional 20-year period of extended operation must be reassessed on a plant-specific basis. In addition, the applicant must request relief from the ISI requirements for volumetric examination of circumferential welds for the extended license term in accordance with the requirements of 10 CFR 50.55a(g).

The staff reviewed the applicant's PoF results which were based on the methodology presented in the BWRVIP-05 report. PoF results were calculated for 54 EFPY for the limiting RPV beltline circumferential weld DE (VCB-A2). The PoF evaluation included the consideration of the LTOP occurrence probability. The applicant did not submit detailed calculations for obtaining PoF values for the limiting beltline circumferential weld and, therefore, in RAI 4.2.4-1 dated September 24, 2009, the staff requested that the applicant submit the calculations for mean RT_{NDT}.

In its response dated October 23, 2009, the applicant provided a mean RT_{NDT} value for the limiting RPV circumferential weld. The staff confirmed the validity of the data for the copper and nickel contents and the initial RT_{NDT} values for the limiting RPV beltline circumferential weld. The staff reviewed the applicant's calculations for the 54 EFPY mean RT_{NDT} value for the limiting RPV circumferential weld using the data presented in the submittal dated October 23, 2009, and found them to be acceptable. The 54 EFPY mean RT_{NDT} value is bounded by the 64 EFPY mean RT_{NDT} value used by the staff for determining the conditional failure probability of a circumferential weld. The 64 EFPY mean RT_{NDT} value from the staff's SE dated July 28, 1998, is representative of a Chicago Bridge and Iron Co. (CB&I) weld because CB&I fabricated the DAEC RPV. Since the DAEC 54 EFPY mean RT_{NDT} value is less than the 64 EFPY value used in the staff's SE dated July 28, 1998, the staff concludes that the RPV conditional failure probability of the limiting DAEC RPV circumferential weld is bounded by the staff analysis, and the PoF value due to a LTOP event at 54 EFPY for the limiting RPV circumferential weld is less than the value used in the staff's SE dated July 28, 1998. Therefore, the staff accepts the applicant's response and considers its concerns related to RAI 4.2.4-1 resolved.

In the July 28, 1998, staff SE for the BWRVIP-05 report, the staff required that examination of the limiting RPV circumferential shell welds must be performed if the corresponding volumetric examinations of the RPV axial shell welds revealed any presence of an age-related degradation mechanism. By letter dated September 24, 2009, the staff issued RAI 4.2.5-1 requesting that the applicant confirm whether previous volumetric examinations of the DAEC RPV axial shell welds have shown any indication of cracking or other age-related degradation mechanisms in the welds. In its response dated October 23, 2009, the applicant stated that no recordable indications of cracking were identified during the previous volumetric examinations of the RPV axial welds at DAEC. The staff accepts this response and considers its concerns related to RAI 4.2.5-1 resolved.

The applicant stated that it will use the same procedures and training used to limit RPV cold overpressure events as those approved by the staff for DAEC to implement the BWRVIP-05 technical alternative for the term of the current operating license. By letter dated October 23, 2009, the applicant provided a response to RAI 4.2.4-2 to state that it will use training procedures (to limit RPV cold overpressure events) described in the applicant's relief request NDE-R07 (Commitment No. 38). This relief request was submitted on February 12, 2004, and was approved by the staff in a letter dated January 6, 2005. Since the training procedures for DAEC were approved by the staff and they are consistent with the BWRVIP-05 report, the staff accepts the applicant's response and considers its concerns related to RAI 4.2.4-2 resolved.

In accordance with 10 CFR 50.55a(g), the staff requires that a request for relief from the ASME Code Section XI ISI requirements for the RPV circumferential welds be submitted for the period of extended operation. The applicant stated that it will submit the necessary relief request prior to the period of extended operation and the staff will review the relief request when it is submitted.

4.2.4.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of RPV circumferential weld examination relief in LRA Section 18.3.1.4. On the basis of its review of the two UFSAR supplements, the staff concludes that the summary description of the applicant's actions to address RPV circumferential weld examination relief is adequate.

4.2.4.4 Conclusion

On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that, for the RPV circumferential weld examination relief TLAA, the analyses have been projected to the end of the period of extended operation. However, the applicant will need to request an extension of the relief for circumferential weld examination for the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the activities for managing the effects of aging and the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.5 Reactor Vessel Axial Weld Probability of Failure

4.2.5.1 Summary of Technical Information in the Application

In LRA Section 4.2.5, the applicant stated that it performed a plant-specific PoF analysis for the RPV beltline axial welds. The applicant estimated the PoF due to a limiting event (i.e., LTOP) for the RPV beltline axial welds. The PoF results were calculated for 60 years (54 EFPY) for the RPV beltline axial weld, including the consideration of the LTOP occurrence probability of 1×10^{-3} per year. The PoF value for the beltline axial weld due to an LTOP event is less than the value specified in the staff's SE for the BWRVIP-05 dated March 7, 2000. The applicant stated that the axial weld probability analysis is projected through the period of extended operation under the provisions of 10 CFR 54.21(c)(1)(ii).

4.2.5.2 Staff Evaluation

The staff reviewed the RPV axial weld structural integrity evaluation and noted that the applicant did not submit detailed calculations for obtaining a mean RT_{NDT} value for the limiting RPV beltline axial weld and, therefore, in RAI 4.2.4-1 dated September 24, 2009, the applicant was requested to submit the corresponding calculated mean RT_{NDT} for the limiting RPV axial weld. In its response dated October 23, 2009, the applicant provided the mean RT_{NDT} values for the limiting RPV beltline axial weld. The staff confirmed the validity of the data for the copper and nickel content and the initial RT_{NDT} value for the limiting RPV beltline axial weld. The staff reviewed the applicant's calculations for the 54 EFPY mean RT_{NDT} value for the limiting RPV axial weld using the data presented in the October 23, 2009, submittal and found them to be acceptable.

With respect to PoF results for 54 EFPY for the limiting RPV beltline axial weld, in its response to RAI 4.2.5-2, dated October 23, 2009, the applicant stated that the PoF value for this weld due to an LTOP event is bounded by the staff-approved value for 64 EFPY value specified in the staff SE dated March 7, 2000. Therefore, the staff accepts the response and considers its concerns related to RAI 4.2.5-2 resolved.

In RAI 4.2.5-1 dated September 24, 2009, the staff requested that the applicant confirm whether or not previous volumetric examinations of the DAEC RPV axial shell welds have shown any indication of cracking or other age-related degradation mechanisms in the welds. In its response dated October 23, 2009, the applicant stated that no recordable indications of cracking were identified during the previous volumetric examinations of the RPV axial welds at DAEC. The staff accepts this response and considers its concerns related to RAI 4.2.5-1 resolved.

Based on its review, the staff finds that the applicant's evaluation for this TLAA is acceptable because the DAEC 54 EFPY conditional failure probability for the limiting RPV axial weld is bounded by the staff analysis in the staff's SE dated March 7, 2000, and the applicant will be using procedures and training to limit cold overpressure events during the period of extended operation.

4.2.5.3 UFSAR Supplement

The applicant also provided a UFSAR supplement summary description of its TLAA evaluation of RPV axial weld PoF in LRA Section 18.3.1.5. On the basis of its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address RPV circumferential weld examination relief is adequate.

4.2.5.4 Conclusion

On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that, for the conditional failure probability of the RPV axial welds TLAA, the applicant's analysis is bounded by the staff analysis in the staff SE dated March 7, 2000, and has been projected to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the activities for managing the effects of aging and the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.6 Reflood Thermal Shock of the Reactor Pressure Vessel

4.2.6.1 Summary of Technical Information in the Application

The applicant, in this TLAA, addressed the concerns regarding a possible brittle failure of the RPV due to reflood of the RPV following a loss-of-coolant accident (LOCA). The current analysis assumed a design basis LOCA followed by a low pressure coolant injection (LPCI) system injection and accounting for the effects of neutron embrittlement at the end of the current license period. The applicant performed a reflood thermal shock analysis as part of a TLAA for the period of extended operation. GE performed a recent analysis using a BWR-6 vessel design which had a larger vessel wall thickness than other U.S. BWRs, thus representing higher stress levels. A recent analysis applicable to the DAEC vessel has been performed using a vessel design similar to the DAEC vessel and taking into account a bounding LOCA event, a main steam break, which represents the most limiting conditions. The applicant stated that the peak stress intensity factor at 1/4T in BWR-6 vessels is more limiting than that experienced by the DAEC vessel. The material fracture toughness value of the DAEC vessel is significantly higher than the bounding peak stress value of the BWR-6 vessel. Therefore, the applicant concluded that the reflood thermal shock analysis as part of the TLAA for the DAEC vessel is acceptable and is projected through the period of extended operation under the provisions of 10 CFR 54.21(c)(1)(ii).

4.2.6.2 Staff Evaluation

The staff reviewed the reflood thermal shock analysis to verify its compliance with 10 CFR 54.21(c)(1)(ii). The existing analysis is valid for the current license period, however, the applicant performed a new analysis taking into account the effect of neutron embrittlement on the RPV material during the period of extended operation. The new analysis uses a BWR-6 vessel design which bounds the DAEC vessel and takes into account a bounding LOCA event, a main steam break, which represents the most limiting conditions. The applicant provided the peak stress intensity factor at the 1/4T location of the RPV wall due to the reflood thermal shock event and the EOL (54 EFPY) fracture toughness value. To complete its review, the staff issued RAI 4.2.6-1 dated September 24, 2009, requesting that the applicant provide: (1) a methodology that was used to obtain the peak stress intensity factor of the RPV material under the reflood thermal shock conditions, and (2) effect of maximum vessel irradiation (E greater than 1 MeV) at 54 EFPY at the mid-core ID RPV location on the applicant's analysis.

In its response dated October 23, 2009, the applicant stated that the BWR-6 analysis was based on a technical paper, "Fracture Mechanics Evaluation of a Boiling Water RPV Following a Postulated Loss of Coolant Accident," by S. Ranganath which was presented at the Fifth International Conference on Structural Mechanics in Reactor Technology, Berlin, Germany, August 1979. The peak stress intensity factor was developed using BWR-6 vessel dimensions. The analysis considers that the pressure stresses are negligible when thermal stresses are fully developed. Thermal stresses were evaluated using two cylinder models, one for BWR-6 vessel dimensions and the other model for the DAEC RPV dimensions. The peak thermal hoop stress for DAEC is smaller than for the BWR-6 model because the wall thickness of DAEC RPV is less than BWR-6 RPV. The temperature of the DAEC vessel at 1/4T location during the reflood thermal shock event is in agreement with the temperature of the BWR-6 vessel at 1/4T location. Therefore, the applicant used the peak stress intensity factor at 1/4T location of the BWR-6 model. The EOL fracture toughness value depends on the ART value at 1/4T location of the RPV. The revised ART value based on the neutron fluence value at 54 EFPY for the DAEC RPV was calculated using RG 1.99, Revision 2. The limiting ART value is less by an amount of 240 °F than the temperature of the DAEC vessel at 1/4T location during the reflood thermal shock event. The temperature at which the reflood thermal shock event occurs allows the fracture toughness value of the DAEC RPV at 1/4T location to remain in the upper shelf region, thereby providing adequate margin against any brittle failure. The value of peak stress intensity factor at the 1/4T location of the DAEC RPV during the reflood thermal shock event is considerably lower than the allowable fracture toughness of the DAEC RPV.

The staff reviewed the response and concludes that the DAEC RPV will not experience brittle failure due to sudden drop in temperature associated with the reflood thermal shock event because: (1) the peak stress intensity factor at 1/4T location of DAEC RPV is considerably less than the revised allowable fracture toughness value, and (2) the revised allowable fracture toughness value at 1/4T location of the DAEC vessel remains in the USE range during the reflood thermal shock event. Therefore, the staff considers that its concern regarding RAI 4.2.6-1 is resolved.

Based on the review above, the staff concludes that the applicant adequately addressed the TLAA issue related to reflood thermal shock of the RPV materials at DAEC.

In RAI 4.2.6-2 dated September 24, 2009, the staff requested that the applicant address the reflood thermal shock analysis for the core shroud component as part of a TLAA. In its response dated October 23, 2009, the applicant stated that reflood thermal shock analysis for core shroud is not part of the CLB and, therefore, it is not a TLAA. The staff accepts this response and considers this issue resolved.

4.2.6.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of reflood thermal shock of the RPV materials due to neutron embrittlement in LRA Section 18.3.1.6. On the basis of its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address reflood thermal shock of the RPV materials due to neutron embrittlement is adequate.

4.2.6.4 Conclusion

On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that, for the reflood thermal shock of the RPV materials due to neutron embrittlement TLAA, the analyses have been projected to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the activities for managing the effects of aging and the TLAA evaluation, as required by 10 CFR 54.21(d).

4.2.7 Reactor Internals

4.2.7.1 Summary of Technical Information in the Application

In LRA Section 4.2.7, the applicant stated that austenitic stainless steel reactor vessel internal (RVI) components that are exposed to a neutron fluence value greater than 5 x 10^{20} n/cm^2 (E greater than 1 MeV) are susceptible to irradiation-assisted stress corrosion cracking (IASCC) which is considered a TLAA. The applicant stated that the following RVI components in DAEC's RPV are subject to IASCC:

(1) shroud circumferential welds H3, H4, and H5 and vertical welds V3 through V8 where the neutron fluence value exceeded the threshold limit at the end of 20 operating cycles

(2) the neutron fluence value at the axial top guide plates which exceeded the threshold limit at the end of 20 operating cycles

(3) the core support plate is expected to exceed the threshold fluence value at 39.8 EFPY

(4) the in-core instrument dry tubes and guide tubes

The applicant further stated that it will manage the aging effect due to IASCC in the aforementioned RVI components by implementing a water chemistry program and BWR Vessel Internals Program as allowed by the provisions of 10 CFR 54.21(c)(1)(iii).

In LRA Section 4.2.7, the applicant states that, consistent with the staff's SE for the BWRVIP-25 report, "BWR Core Plate Inspection and Flaw Evaluation Guidelines," the evaluation of radiation induced stress relaxation (results in loss of preload) of the core plate rim hold-down bolts is considered a TLAA. Since DAEC has not installed core plate wedges, the loss of preload was evaluated as part of TLAA. The analysis assumed that a 360 degree crack initiated at the bolt radius after 5 years of operation with a loss of preload after 60 years of operation. The applicant stated that its analysis showed that the core plate integrity is not compromised even with cracked hold-down bolts that lost their preload resulting from 60 years of operation. The applicant determined that its analysis is valid until the end of the period of extended operation under the provisions of 10 CFR 54.21(c)(1)(i).

4.2.7.2 Staff Evaluation

The applicant evaluated the TLAA issue related to IASCC in RVI components by complying with the BWRVIP which includes inspection and flaw evaluation (I&E) guidelines addressed in the applicable BWRVIP reports, and with the water chemistry program. The susceptible RVI components are: (1) core shroud horizontal welds H3, H4, and H5 and vertical core shroud welds V3 through V8, (2) axial top guide plates, (3) the core support plate, and (4) in-core instrumentation dry tubes and guide tubes. The staff determined that compliance with the inspection guidelines specified in the appropriate BWRVIP reports will provide adequate measures for effectively monitoring IASCC in susceptible RVI components. Proper control of reactor coolant system (RCS) water is essential in minimizing the occurrence of IASCC. Since the applicant implemented the industry developed BWR Water Chemistry Program, the staff believes that the applicant will effectively monitor IASCC of the RVI components. To ensure that the TLAA evaluation of IASCC in RVI components is adequately addressed, the staff issued the following RAIs dated September 24, 2009.

GALL Report Table item IV.B1-17 requires that 5 percent of the top guide locations that are exposed to a neutron fluence exceeding the IASCC threshold limit of 5×10^{20} (E greater than 1 MeV) prior to the period of extended operation shall be inspected using an enhanced visual testing (EVT-1) technique within six years after entering the period of extended operation. An additional 5 percent of the top guide locations with an exposure to a neutron fluence value greater than IASCC threshold limit shall be inspected within twelve years after entering into the period of extended operation. The applicant included the aforementioned GALL Report requirement in Commitment Nos. 2 and 3 in LRA Section 18.4, Table A-1. In RAI 4.2.7-2, the staff requested that the applicant include a statement in LRA Section 4.2.7 that refers to Commitment Nos. 2 and 3. Consistent with the staff's request, the applicant supplemented LRA Section 4.2.7 to include Commitment Nos. 2 and 3. The staff accepts this response and considers its concern related to RAI 4.2.7-2 adequately resolved.

The applicant stated that core shroud circumferential welds H3, H4, and H5 and vertical welds V3 though V8 have exceeded the IASCC threshold neutron fluence value. Hence, the staff issued RAI 4.2.7-3 requesting the applicant to confirm that it will implement the requirements specified in footnote 4 of Tables 2-1 and C-9 of the BWRVIP-76, "BWR Vessel Internals Project BWR Core Shroud Inspection and Flaw Evaluation Guidelines," report for these core shroud welds. In its response dated October 23, 2009, the applicant agreed to implement requirements specified in footnote 4 of Tables 2-1 and C-9 of the BWRVIP-76 report when evaluating the structural integrity of the core shroud welds that are exposed to a neutron fluence value exceeding the threshold value. The staff accepts this response and considers that its concern regarding RAI 4.7.2-3 is adequately resolved.

The staff evaluated the applicant's evaluation of aging effect due to stress relaxation in core plate hold-down bolts in which the applicant stated that this aging effect is considered as a TLAA and managed in accordance to 10 CFR 54.21(c)(1)(i). The staff issued RAI 4.2.7-1 requesting that the applicant provide a plant-specific TLAA analysis for the core plate hold-down bolts for staff review and approval.

In its response dated October 23, 2009, the applicant stated that a plant-specific TLAA evaluation for the core plate hold-down bolts for the period of extended operation is currently not available, therefore, the applicant added a new License Renewal Commitment No. 47 indicating that 2 years prior to the period of extended operation, the applicant will submit its TLAA evaluation for the core plate hold-down bolts. Subsequent to this response, the applicant withdrew Commitment 47 and revised Commitment No. 37 by letter dated March 9, 2010. Commitment 37 . had addressed only the inspection aspects of the core plate hold-down bolts. The revised Commitment 37 that was sent on March 9, 2010, addresses both TLAA evaluation for the core plate hold-down bolts and the inspection aspects (discussed in the next paragraph) of the core plate hold-down bolts. In the revised Commitment 37, the applicant stated that it will either install wedges to the core plate or perform analysis of the core plate rim hold-down bolts that demonstrates adequacy to perform their intended function including loss of preload prior to the period of extended operation including the effects of projected neutron fluence. With respect to the TLAA analysis, the staff reviewed the newly revised Commitment 37 and accepts it as it complies with the guidelines specified in the BWRVIP-25 report. Based on the applicant's revised commitment, the staff finds the approach acceptable in accordance with 10 CFR 54.21(c)(1)(iii), instead of the applicant's original disposition of 10 CFR 54.21(c)(1)(i).

Regarding the future inspections of the core plate hold-down bolts, in a letter dated October 23, 2009, the applicant's original Commitment No. 37 stated that a sample of the core plate hold-down bolts will be inspected using visual testing (VT-3) techniques, as inspections with EVT-1 are difficult and have limited value. The applicant stated that it will continue to use VT-3 until an expanded technical basis for not inspecting them is approved by the staff. The staff reviewed the response and indicated to the applicant that it needed to continue to perform the scheduled inspections using EVT-1 technique in order to be consistent with the BWRVIP-25 report, and that VT-3 is not adequate substitute technique**.** By letter dated March 9, 2010, the applicant provided a revision to Commitment No. 37, which stated that the inspection of core plate hold-down bolts shall be performed per the inspection guidelines specified in BWRVIP-25 report. With respect to inspection aspects, the staff reviewed the revised Commitment 37 and accepts it because it complies with the guidelines addressed in the BWRVIP-25 report, or a deviation disposition will be developed and submitted in accordance with BWRVIP-94.

Based on the review above**,** the staff concludes that by implementing the inspection techniques, frequency of inspections, and flaw evaluation methodology that are addressed in the staff-approved applicable BWRVIP reports, the applicant will effectively monitor the aging effect due to IASCC in the RVI components. Additionally, the applicant's compliance with the industry developed BWR Water Chemistry guidelines will adequately control RCS water chemistry thereby reducing the IASCC susceptibility of the RVI components.

4.2.7.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of the RVIs in LRA Section 18.3.1.7, Appendix A. On the basis of its review of the UFSAR supplement, the staff concudes that the summary description of the applicant's actions to address the RVIs is adequate.

4.2.7.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the aging effect due to IASCC in the RVI components would be managed during the period of extended operation. With respect to stress relaxation in core plate hold-down bolts, the applicant with manage the aging effect by completing one of the following actions prior to entering the period of extended operation:

- Install core plate wedges to eliminate the function of core plate hold down bolts

- Perform analysis of the core plate rim hold down bolts that demonstrates adequacy to perform their intended function including loss of pre-load in the period of extended operation including the effects of projected neutron fluence. Inspection of core plate hold down bolts will be performed in accordance with BWRVIP-25, or a deviation disposition will be developed and submitted in accordance with BWRVIP-94.

The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d) and, therefore, is acceptable.

4.3 Metal Fatigue

In LRA Section 4.3, the applicant stated that fatigue is the progressive localized permanent structural change that occurs in a material subjected to repeated or fluctuating strains at nominal stresses having maximum values often much less than the tensile strength of the material. The applicant further stated that, for the RPV, fatigue is based on the postulated cycles during operation of the plant; the most common of these being the startup/shutdown cycle. In order for the applicant to address this design consideration for the RPV, explicit metal fatigue calculations were specified in the ASME Boiler and Pressure Vessel (B&PV) Code.

4.3.1 Reactor Pressure Vessel Fatigue Analyses

4.3.1.1 Summary of Technical Information in the Application

By letter dated January 23, 2009, the applicant submitted Supplement 1 to its LRA. The applicant stated that the original RPV stress report included a fatigue analysis for the RPV components based on a set of design basis duty cycles to assure that the cumulative usage factors (CUFs) do not exceed the ASME Code allowable limit of 1.0. The applicant further stated that, in 1998, its personnel performed a fatigue reassessment of the RPV and that the evaluation was intended to remove excess conservatism from the existing fatigue calculations for all RPV components, and to incorporate transient cycles projected to occur at 40 years based on actual plant operation that were available at the time. The applicant stated that this 1998 reassessment was performed using the same methodology used by the original RPV Stress Report.

The applicant stated that the evaluations were also performed to support NRC approval of extended power uprate (EPU). However, the EPU evaluations did not incorporate the 1998 fatigue reassessment and this issue was entered into the corrective action program. The applicant stated the re-evaluation of fatigue to support license renewal included the effort to resolve the discrepancies between the EPU evaluation and the 1998 reassessment. In addition, the applicant performed revised fatigue evaluations for the main closure region to support reduced-pass stud tensioning performed in the 2007 refueling outage (RFO).

The applicant stated it used a forward projection methodology that uses trending from the 1998 through 2005 time period of plant operation to determine the number of transient cycles that should be assumed in the 60-year fatigue calculations. The applicant stated that this method eliminates the effects of early plant operation where cyclic accumulation was high, and it more properly reflects the most recent operating trends. Furthermore, for selected events, additional conservatism was added beyond the mathematically projected number of cycles to accommodate potential variation in plant performance late in plant life, as well as to allow for additional events where the projected number of cycles was very low and the likelihood of additional events could not be ruled out.

The applicant stated that certain components meet the requirements of Paragraph N-415.1 of ASME Section III for exemption from fatigue analysis. The applicant further stated to validate these exemptions for 60 years of operation, new fatigue exemption analyses were performed using the projected number of cycles for 60 years. The applicant's analyses validated the fatigue exemption for 60 years of operation.

The Metal Fatigue of Reactor Coolant Pressure Boundary Program will monitor the numbers of cycles of the design transients and assure action is taken prior to any analyzed numbers of transients being exceeded and will manage the effects of aging due to fatigue on the reactor vessel. The applicant stated that its disposition of the RPV components fatigue TLAAs is in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.1.2 Staff Evaluation

The staff reviewed LRA Section 4.3.1, to verify pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation.

LRA Section 4.3.1 states that in 1998 a reassessment of the RPV was performed to remove excess conservatism from the existing fatigue calculations for all RPV components, and to incorporate transient cycles projected to occur at 40 years based on actual plant operation as of that time. The staff noted that, in LRA Table 4.3-2, "Usage Factors," the applicant provided the 40-year CUFs from the 1998 reassessment and not the original design 40-year CUFs. The staff also noted that there was no description of the type of conservatism that was removed during the 1998 reassessment. By letter dated September 14, 2009, the staff issued RAI 4.3.1-1 requesting that the applicant: (1) provide a side-by-side comparison of the CUF of the original design values and the reassessed values for the components identified in LRA Table 4.3-2, (2) describe the conservatisms that were removed for the 1998 reassessment, (3) provide justification that some locations in LRA Table 4.3-2 are exempted from fatigue evaluations, and (4) confirm that the CUF values shown in LRA Table 4.3-2 have accounted for the EPU operating conditions.

In its response to RAI 4.3.1-1, Part 1, dated October 13, 2009, the applicant provided a table with a direct comparison between the original design CUF values from Chicago Bridge & Iron and the CUF values from the 1998 reassessment. The staff noted that several CUF values were higher after the 1998 reassessment. The staff finds the increases in CUF values after the 1998 reassessment to be reasonable because reassessment incorporated transient cycles that were expected to occur based on data from actual plant operation. The staff also noted that several CUF values were lower after the 1998 reassessment. The applicant provided further discussion as to why these CUF values were lower after the 1998 reassessment, in RAI 4.3.1-1, Part 2, which is discussed below.

Based on its review, the staff finds the applicant's response to RAI 4.3.1-1, Part 1, acceptable because: (1) the applicant provided a direct comparison between the original design CUF values and the CUF values from the 1998 reassessment, (2) the decrease in CUF values after the 1998 reassessment is reasonable, as described in RAI 4.3.1-1, Part 2, and (3) the increase in CUF values is reasonable as described above. The staff's concern described in RAI 4.3.1-1, Part 1, is resolved.

In its response to RAI 4.3.1-1, Part 2, dated October 13, 2009, the applicant stated that certain CUF values in the 1998 reassessment were less than the CUF values in the original design report from CB&I. The applicant further stated that these locations are the shroud support point 21 and certain feedwater nozzle locations (safe end points 1-6 and 10-16 and thermal sleeve points 7 and 8). The applicant stated that, for the shroud support point 21, the original design analysis assumed that the transient event that produces the largest alternating stress range, loss of feedwater, is applicable to all cycles (including hydrotest, startup/shutdown, etc.). However, for the 1998 reassessment, the applicant has determined the actual alternating stress intensity for the hydrotest and this was used for the usage factors of the hydrotest cycles only. The applicant clarified that the stress intensity for the loss of feedwater transient was applied to the remaining cycles (startup/shutdown, etc.) and the CUF was determined by the use of Miner's Rule. The staff finds the applicant's use of Miner's Rule is in accordance with NB-3200 of ASME Code Section III for fatigue evaluations and, therefore, acceptable. The applicant stated that, although conservatism was reduced, the evaluation still contains added conservatism because the larger alternating stress intensity was applied to the remaining transients other than to loss of feedwater.

The applicant also explained that for the feedwater nozzle locations, the 1998 reassessment reduced conservatism in the calculation of the skin stress. The applicant stated that the original fatigue analysis calculated the peak skin stress with the following equation $\sigma = S1(E\alpha\Delta T)/(1- \nu)$, in which a value of 0.7 was used for S1. The applicant further stated that for the 1998 reassessment, a more realistic estimate of S1 was determined by using the Biot modulus, which resulted in a value of 0.5 for S1. The staff noted that this resulted in a lower stress range, and thus a lower CUF value for the 1998 reassessment. The staff finds the applicant's approach reasonable because it used a value for S1 that was more realistic.

Based on its review, the staff finds the applicant's response to RAI 4.3.1-1, Part 2, acceptable because: (1) the applicant clearly identified and explained the areas in which conservatism was removed and (2) adequately justified the removal of this conservatism, as described above. The staff's concern described in RAI 4.3.1-1, Part 2, is resolved.

In its response to RAI 4.3.1-1, Part 3 dated October 13, 2009, the applicant stated that ASME Code Section III permits exemption from fatigue analysis if all of the requirements of paragraph N-415.1 are satisfied. The applicant provided subparagraphs (a)-(f) of N-415.1 detailing the requirements outlined in ASME Code Section III. The staff noted that the applicant has determined that certain locations in LRA Table 4.3-2 are exempted and remain exempt for fatigue evaluations in accordance with the requirements in paragraph N-415.1 of ASME Code Section III.

Based on its review, the staff finds the applicant's response to RAI 4.3.1-1, Part 3, acceptable because the applicant has determined, in accordance with the requirements in paragraph N-415.1 of ASME Code Section III, that certain locations are exempt from fatigue calculations. The staff's concern described in RAI 4.3.1-1, Part 3, is resolved.

In its response to RAI 4.3.1-1, Part 4, dated October 13, 2009, the applicant confirmed that the 60-year CUF values provided in LRA Table 4.3-2 include the effects of EPU operating conditions and that they also took into account the 1998 reassessment, power uprate evaluations and the impact of other evaluations, such as the revised fatigue evaluation for the main closure region referenced in LRA Section 4.3.1. The staff noted that the applicant stated in LRA Section 4.3.1 that the evaluation to support license renewal included an effort to resolve the discrepancies between the EPU evaluations and the 1998 reassessment.

Based on its review, the staff finds the applicant's response to RAI 4.3.1-1, Part 4, acceptable because: (1) the applicant confirmed that the EPU operating conditions were incorporated into its 60-year CUF values and (2) the applicant stated in its LRA that the evaluations for license renewal considered both the 1998 reassessment, EPU evaluations, and any discrepancies between the two. The staff's concern described in RAI 4.3.1-1, Part 4, is resolved.

Based on its review, the staff finds the applicant's response to RAI 4.3.1-1 acceptable in its entirety as described above. The staff's concern described in RAI 4.3.1-1 is resolved.

The staff noted the original design fatigue analyses and the 1998 reassessment, represents two sets of fatigue analyses results for the RPV components. The staff noted that the LRA does not state which set of results are listed in LRA Table 4.3-2. By letter dated October 16, 2009, the staff issued RAI 4.3.1-1.1, requesting that the applicant clarify which results are listed in LRA Table 4.3-2 and, if they are from the 1998 reassessment, then why do 60-year projected CUF values for some locations, such as the main closure and control rod drive hydraulic system return (CRD-HSR) nozzle safe end, still show additional significant reductions when the excessive conservatism has already been removed in the 1998 reassessment. The staff also requested that the applicant clarify that if it represents the original design analysis, then what was the true purpose of the 1998 reassessment and where were the results used.

In its response dated November 16, 2009, the applicant stated that, for each location, the 60-year CUF values were determined by identifying the previous CUF calculations and the previous fatigue calculation from the governing stress report was reproduced. The applicant further stated a revised calculation was then prepared to provide the CUF values for 60-years of operation using projected cycle counts as shown in LRA Table 4.3-1 and relevant EPU effects. The applicant stated that the end result is the "CUF 40 year" column in LRA Table 4.3-2, which presents the values from the governing stress report, with minor round-off differences or corrections as discussed below. Furthermore, the governing stress report was the 1998 reassessment, except for the main closure studs, shroud support point 21, feedwater nozzle, control rod drive (CRD) penetration (RPV wall grinding), CRD-HSR, recirc inlet nozzle safe end, and recirc outlet nozzle. The staff noted that, for these locations, the applicant provided an explanation as to where the CUF values were obtained from (EPU evaluation or original design stress report), the conservatism that was removed when calculating the projected 60-year CUF values, and any errors that were corrected between the time of the 1998 reassessment and the submittal of the LRA.

Based on its review, the staff finds the applicant's response to RAI 4.3.1-1.1 acceptable because: (1) the applicant's CUF values were taken from its governing stress reports from the 1998 reassessment and (2) the applicant provided an adequate basis for those locations where the CUF values were not taken from the 1998 reassessment (EPU evaluations, original design stress report, and correction of errors during evaluation). The staff's concern described in RAI 4.3.1-1.1 is resolved.

LRA Section 4.3.1 states that the transient cycle projections were made using forward projection methodology that uses trending from the 1998 through 2005 time period of plant operation. Furthermore, the applicant stated that for selected events, additional conservatism was added beyond the mathematically projected number of cycles to accommodate potential variation in plant performance late in plant life. It was not clear to the staff if 7 years of data is appropriate for making a long-term projection and what conservatism has been used in the cycle projections. By letter dated September 14, 2009, the staff issued RAI 4.3.1-2 requesting that the applicant: (1) justify that cycle projections based on the most recent 7 years of plant data is adequate and (2) describe the conservatism in the cycle projections.

In its response to RAI 4.3.1-2, Part 1, dated October 13, 2009, the applicant stated that the cycle projections were based on trending from the 1998 through 2005 time period of plant operation and this time period corresponds to the time during which data were available from the surveillance test procedure (STP). The staff noted that LRA Section 4.3.1 states that the cycle projections used the data from 1998-2005 because cyclic accumulation during the early years of plant operation were high. The staff noted that from the early years of plant operation, nuclear power plants have operated more effectively based on lessons learned and industry operating experience. The staff further noted that recent trends are a more accurate representation of operation at the nuclear power plant. The staff finds the applicant's use of more recent operating data for its cycle projection reasonable because nuclear power plants have operated more effectively based on lessons learned and industry operating experience.

Based on its review, the staff finds the applicant's response to RAI 4.3.1-2, Part 1, acceptable because (1) the applicant provided an adequate basis for its cycle projections, as described above and (2) the applicant has dispositioned all RPV components pursuant to 10 CFR 54.21(c)(1)(iii), so that the effects of aging on the intended functions will be adequately managed for the period of extended operation such that corrective actions will be initiated prior to loss of intended function. The staff's concern described in RAI 4.3.1-2, Part 1, is resolved.

In its response to RAI 4.3.1-2, Part 2, dated October 13, 2009, the applicant provided the method that was used to project forward to 60 years of plant operation. The staff noted that the applicant used the rate of occurrence of the particular transient between 1998 and 2005 which was multiplied by the time from 2005 until the end of the period of extended operation (2034) and was then added to the total number of accrued cycles in 2005. The staff finds this approach reasonable because nuclear power plants have operated more effectively based on lessons learned and industry operating experience. The applicant stated that additional conservatism was added by increasing the number of scram cycles for 60 years from 119 cycles calculated based on the method described above to 150 cycles. The staff finds the addition of these scram cycles acceptable because the applicant accounted for potential variations in plant operating effectiveness. The applicant stated conservatism was also added to those transients where the projected cycles yielded zero cycles (those transients in which no cycles have been recorded). The applicant further stated that a conservative assumption of 2 cycles was used for the 60-year evaluation instead.

Based on its review, the staff finds the applicant's response to RAI 4.3.1-2, Part 2, acceptable because: (1) the applicant provided its formula for calculating its 60-year cycle projection, which is appropriately and reasonably based on recent operating data, (2) the applicant added conservatism to those cycles for which potential variations in plant operating effectiveness may be present, (3) the applicant added conservatism to those cycles that have never occurred to date, and (4) the applicant has dispositioned all RPV components pursuant to 10 CFR 54.21(c)(1)(iii), so that the effects of aging on the intended functions will be adequately managed for the period of extended operation. The staff's concern described in RAI 4.3.1-2, Part 2, is resolved.

Based on its review, the staff finds the applicant's response to RAI 4.3.1-2 acceptable in its entirety as described above. The staff's concern described in RAI 4.3.1-2 is resolved.

LRA Table 4.3.1 provides the transients and cycles used for the CUF calculation as well as the accrued cycles after approximately 30 years, and the 60-year cycle projections. However, the staff noted that the transients shown in LRA Table 4.3-1 do not correspond to those in UFSAR Table 5.3-7. The staff noted that the UFSAR Table 5.3-7 contains CRD isolation (50 design cycles), single CRD scram (10 design cycles), and 125 percent design hydrostatic pressure test (two design cycles); however, none of these transients are included in LRA Table 4.3.1. In addition, the staff noted the startup/shutdown transient shows 160 design cycles in UFSAR Table 5.3-7, whereas it shows 120 design cycles in the LRA Table 4.3.1.

By letter dated September 14, 2009, the staff issued RAI 4.3.1-3 requesting the applicant: (1) justify that the transients and number of cycles defined in LRA Table 4.3-1 is acceptable when they differ from those defined in the UFSAR Table 5.3-7, and (2) justify that the CUF values of the original design analyses can be used as the basis for making CUF projections since, the transients used for license renewal are different from those that constitute the CLB.

In its response to RAI 4.3.1-3, Part 1, dated October 13, 2009, the applicant stated that UFSAR Table 5.3-7 was revised in UFSAR Revision 20 (2009), as part of the plant corrective action program, to resolve the discrepancies between the 1998 reassessment and the EPU fatigue evaluation. The applicant stated 40-year cycle numbers are now in agreement between the two tables, with one exception. The applicant stated that LRA Table 4.3-1 lists three design cycles for the hydrostatic test, whereas UFSAR Table 5.3-7 lists two design cycles, with a note that one of the design documents lists three design cycles. The staff finds this difference trivial and acceptable because only one hydrostatic test has been performed and this test is no longer performed. The applicant stated that the transients listed in LRA Table 4.3.1 corresponds to those in UFSAR Table 5.3-7, with the exception of CRD isolation and single CRD scram. The applicant further stated that these two transients were used in the determination of the 40-year and 60-year CUF values in LRA Table 4.3-2, even though they are not listed in LRA Table 4.3.1. The applicant clarified that these transients apply to the evaluations for the CRD penetration (i.e., housing, stub tube, vessel wall, stub tube-to-RPV weld, and RPV wall grinding) locations. The staff finds it acceptable that these two transients are not listed in LRA Table 4.3.1 because the applicant has confirmed that these two transients have been incorporated into the fatigue evaluations (40-year and 60-year CUF values) at the affected locations (CRD penetration locations).

Based on its review, the staff finds the applicant’s response to RAI 4.3.1-3, Part 1, acceptable because: (1) UFSAR Table 5.3-7 was revised to resolve the discrepancies between the 1998 reassessment and the EPU fatigue evaluation and (2) the applicant has adequately justified any differences between UFSAR Table 5.3-7 and LRA Table 4.3.1, as described above. The staff’s concern described in RAI 4.3.1-3, Part 1, is resolved.

In its response to RAI 4.3.1-3, Part 2, dated October 13, 2009, the applicant stated that the CUF values from the original design analyses were not the sole basis for making the 60-year CUF value determinations, and that pertinent input from later fatigue evaluations, including the 1998 fatigue reassessment and EPU, were taken into account in the evaluation of CUF values for 60 years. The applicant further stated that the transients used in the determination of CUF values for 60 years are consistent with those contained in the revised UFSAR Table 5.3-7.

Based on its review, the staff finds the applicant’s response to RAI 4.3.1-3, Part 2, acceptable because: (1) the applicant clarified that the original design analyses are not the sole basis for its CUF values for 60 years, (2) the applicant incorporated appropriate information from the 1998 reassessment and EPU fatigue evaluations into its CUF values for 60 years, and (3) the applicant has dispositioned all RPV components pursuant to 10 CFR 54.21(c)(1)(iii). Therefore, the aging components with an intended function will be adequately managed for the period of extended operation. The staff's concern described in 4.3.1-3, Part 2, is resolved.

Based on its review, the staff finds the applicant's response to RAI 4.3.1-3 acceptable in its entirety as described above. The staff's concern described in 4.3.1-3 is resolved.

4.3.1.3 UFSAR Supplement

The applicant provided the UFSAR supplement summarizing its TLAA evaluation of the RPV and RPV components in LRA Section A.18.3.2.1. Based on its review of the UFSAR supplement, the staff concludes that the applicant provided an adequate summary description of its actions to address the fatigue evaluation of the RPV.

4.3.1.4 Conclusion

On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging due to fatigue on the intended functions of the RPV will be adequately managed during the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.2 Reactor Vessel Internals Fatigue Analyses

4.3.2.1 Summary of Technical Information in the Application

By letter dated January 23, 2009, the applicant submitted Supplement 1 to its LRA. The applicant stated that the RPV internals are not Class 1 pressure boundary components and, as such, no plant-specific fatigue analysis was performed for the entire RVIs. The applicant further stated that the shroud support is considered part of the vessel and the CUF value calculated in the vessel stress report for the shroud support is included in LRA Table 4.3-2.

4.3.2.2 Staff Evaluation

The staff reviewed LRA Section 4.3.2 to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation, for the shroud support.

LRA Section 4.3.2 states that no fatigue analysis of the entire RVIs was performed because the RVIs are not Class 1 pressure boundary components, except for the shroud support, which is considered part of the vessel. The staff noted that, even though these components are non-pressure boundary 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, but RVIs may be implicitly designed for low cycle fatigue based upon the RCS design transient projections for 40 years. In RAI 4.3.2-1 dated September 14, 2009, the staff requested that the applicant justify why fatigue requirements are not addressed for the RVI components except for the shroud support.

In its response dated October 13, 2009, the applicant stated the criteria for a TLAA as defined in 10 CFR 54.3. The staff noted that all six criteria, as defined in 10 CFR 54.3, must be met in order to be classified as a TLAA. Specifically, the staff noted that 10 CFR 54.3(a)(6) states that TLAAs are those applicant calculations and analyses that "are contained or incorporated by reference in the CLB." The applicant stated that, during its review of its CLB, it did not identify a fatigue evaluation that was performed for the RPV internals. The applicant further stated, as discussed in LRA Section 4.3.2, the shroud support is considered part of the RPV and was, therefore, evaluated for fatigue and is considered a TLAA. The staff confirmed that shroud support was evaluated in LRA Section 4.3.1.

Based on its review, the staff finds the applicant's response to RAI 4.3.2-1 acceptable because the applicant reviewed its CLB and verified that there are no calculations and analyses that meet the definition of a TLAA, as defined in 10 CFR 54.3(a) and specifically there are no calculations and analyses that are contained or incorporated by reference in its CLB. The staff's concern described in RAI 4.3.2-1 is resolved.

4.3.2.3 UFSAR Supplement

The applicant provided the UFSAR supplement summarizing the DAEC TLAA evaluation of RVIs fatigue in LRA Section A.18.3.2.2. Based on its review of the UFSAR supplement, the staff concludes that the applicant provided an adequate summary description of its actions to address the fatigue evaluation of the RVIs fatigue.

4.3.2.4 Conclusion

On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.3(a), that there is no plant-specific and therefore RVIs fatigue analysis is not a TLAA and, as discussed above in SER Section 4.3.1.2, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging due to fatigue on the intended functions of the shroud support will be adequately managed during the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.3 Fatigue of Class 1, 2, and 3 Piping and Components

4.3.3.1 Summary of Technical Information in the Application

By letter dated January 23, 2009, the applicant submitted Supplement 1 to its LRA. The applicant stated that its Class 1 piping systems were designed in accordance with B31.1 or B31.7 requirements and those piping systems designed in accordance with B31.7 were explicitly analyzed for fatigue. The applicant stated that the analyses demonstrated that the 40-year CUF values for the limiting components in the affected systems were below the ASME Code Section III allowable value of 1.0, or that the systems were exempt from fatigue analysis.

Furthermore, the applicant stated that these B31.7 analyses are based on cycles postulated to occur in the current 40-year design life, therefore, they are TLAAs. The applicant stated the B31.7 fatigue evaluations have been reviewed to ensure that the piping remains acceptable from a fatigue standpoint for 60 years of plant operation.

The applicant stated that those B31.7 piping analyses which included a determination of CUF values were reviewed to determine whether the CUF value would remain below 1.0 when multiplied by 1.5 (60 years/40 years). The applicant further stated that, if the fatigue is seen to be acceptable for 60-year operation, then further evaluation is not needed. Furthermore, in several instances, further evaluation was needed and, in those cases, 60-year CUF values were evaluated based on using the numbers of cycles provided in LRA Table 4.3-1. The applicant has concluded that these evaluations showed that the 60-year CUF values remain below 1.0 and, therefore, the piping systems are acceptable from a fatigue standpoint for 60 years of plant operation. The applicant stated that those analyses for which the current design basis includes a fatigue exemption were also reviewed to determine acceptability for 60 years of operation. The applicant has concluded that the review of the fatigue analysis exemptions for 60-year cycles shows that these piping systems remain fatigue exempt and are acceptable from a fatigue standpoint for 60 years of plant operation.

The applicant stated that, for the systems that were designed in accordance with B31.1 methodology, fatigue usage factors were not determined and for these systems a stress range reduction factor which is applied to the allowable stress range for expansion stresses is required to account for cyclic thermal conditions. The applicant further stated the stress range reduction factor is 1.0 for 7,000 equivalent full temperature thermal cycles (or less) and is incrementally reduced to 0.5 for 100,000 cycles (or more). The applicant stated that the license renewal evaluation determines if the number of cycles for 60-years would require a reduction in stress beyond that originally applied during the original design process.

The applicant stated that, since the piping systems connected to the vessel are generally cycled in parallel with reactor operations, the 60-year transient cycles for the reactor vessel components in LRA Table 4.3-1 can be used to estimate the cycles for the piping systems. The applicant further stated that the total of the transient cycles for 60-years is 486. The applicant has concluded that this is less than the 7,000 limit for a stress range reduction factor of 1.0 and the original design considerations for fatigue have been shown to remain valid for the period of extended operation.

The applicant stated that the design code for Class 2 and 3 piping systems is in accordance with B31.1 or B31.7, which states that no explicit analysis for fatigue was required. The applicant further stated that for these systems, a stress range reduction factor, which is applied to the allowable stress range for expansion stresses, is required to account for cyclic thermal conditions. The stress range reduction factor is 1.0 for 7,000 equivalent full temperature thermal cycles (or less) and is incrementally reduced to 0.5 for 100,000 cycles (or more). The applicant has determined that these analyses contain an implicit cycle limit and, therefore, are considered TLAAs.

The applicant stated that the license renewal evaluation determines if the number of cycles for 60 years would require a reduction in stress beyond that originally applied during the original design process. The applicant further stated that, since the piping systems connected to the vessel are generally cycled in parallel with reactor operations, the 60-year transient cycles for the reactor vessel components in LRA Table 4.3-1 can be used to estimate the cycles for the piping systems. The applicant further stated that the total of the transient cycles for 60 years is 486. The applicant has concluded that this is less than the 7,000 limit for a stress range reduction factor of 1.0 and the original design considerations for fatigue have been shown to remain valid for the period of extended operation.

The applicant state that the fatigue of Class 1, 2, and 3 piping and components TLAAs is in accordance with 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(ii) that the TLAA remains valid during the period of extended operation and that the TLAA is projected to the end of the period of extended operation, respectively.

4.3.3.2 Staff Evaluation

The staff reviewed LRA Section 4.3.3, to verify pursuant to 10 CFR 54.21(c)(1)(i), that the TLAA remains valid during the period of extended operation, and 10 CFR 54.21(c)(1)(ii), that the TLAA is projected to the end of the period of extended operation.

LRA Section 4.3.3 states 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 Code to demonstrate that analysis for cyclic operation is not required.” The staff noted that it did not state the criteria/code that was used to exempt locations from fatigue analysis. By letter dated September 14, 2009, the staff issued RAI 4.3.3-1 requesting that the applicant describe the criteria used by the “fatigue analysis exemption evaluation” to exempt locations from fatigue analysis.

In its response dated October 13, 2009, the applicant stated that ASME Code Section III contains provisions where the determination of CUF values for piping components is not required. The applicant further stated that piping components may not require analysis for cyclic operation if the components meet the requirements of subparagraph NB-3222.4(d). The applicant provided the specific provisions from NB-3222.4(d) that were used to exempt locations from fatigue analysis.

Based on its review, the staff finds the applicant’s response to RAI 4.3.3-1 acceptable because: (1) the applicant performed its fatigue analysis exemption evaluation based on the requirements of ASME Code Section III Subparagraph NB-3222.4(d), and (2) the applicant has concluded that these locations are exempt from fatigue analysis. The staff’s concern described in RAI 4.3.3-1 is resolved.

In LRA Section 4.3.3, the applicant dispositions the TLAA for Class 1, 2, and 3 piping components in accordance with both 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(ii). However, the staff noted that the regulatory disposition statements are not specific on which portions or piping components are dispositioned in accordance with 10 CFR 54.21(c)(1)(i) or 10 CFR 54.21(c)(1)(ii). By letter dated September 14, 2009, the staff issued RAI 4.3.3-2 requesting that the applicant identify which portions of the piping components are dispositioned in accordance with 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(ii).

In its response dated October 13, 2009, the applicant amended its LRA so that LRA Section 4.3.3, on page 4.3-6, reads as follows:

> Disposition: 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(ii) as shown below:
>
> (i) The analyses remain valid for the period of extended operation:
>
> - Class 1 piping systems designed in accordance with B31.1 methodology
> - Fatigue-exempt Class 1 piping systems

- Class 2 and 3 piping systems designed in accordance with B31.1 or B31.7

(ii) The analyses have been projected to the end of the period of extended operation:

- Class 1 piping systems designed in accordance with B31.7

Based on its review, the staff finds the applicant's response to RAI 4.3.3-2 acceptable because the applicant amended its LRA to clearly identify the disposition in accordance with 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(ii) for the specific portions of its Class 1, 2, and 3 piping systems. The staff's concern described in RAI 4.3.3-2 is resolved.

The staff noted that the applicant's Class 1 piping systems are designed in accordance with B31.1 and its Class 2 and 3 piping systems are designed in accordance with B31.1 or B31.7, such that a stress range reduction factor is applied to the allowable stress range for expansion stresses to account for cyclic thermal conditions. The staff further noted that a stress range reduction factor for these systems is 1.0 for 7,000 equivalent full temperature thermal cycles. The applicant stated that, for license renewal, an evaluation to determine if the number of cycles for 60 years would require a reduction in stress beyond that originally applied during the original design process was performed and these assessments can be made by comparing the design cycles projected to occur in 60 years against the 7,000 cycle criterion for a stress range reduction factor of 1.0. The applicant stated that since the piping systems connected to the vessel are generally cycled in parallel with reactor operations, the 60-year transient cycles for the reactor vessel components in LRA Table 4.3-1 can be used to estimate the cycles for the piping systems, which is a total of 486 transient cycles for 60 years. The staff noted that this is significantly lower than the 7,000 cycles these piping systems were designed to and that these analyses will remain valid for the period of extended operation.

The staff noted that portions of the applicant's Class 1 piping systems include a fatigue exemption in the current design basis. The applicant performed a review of these fatigue exemptions and has determined that they remain fatigue exempt for the period of extended operation.

The applicant stated that, in LRA Section 4.3.3, in several instances, further evaluation was needed, in which 60-year CUFs were evaluated based on using the numbers of cycles provided in LRA Table 4.3-1 and the evaluations showed that the 60-year CUFs remain below 1.0 and, therefore, the piping systems are acceptable from a fatigue standpoint for 60 years of plant operation. The staff noted that in order for the Class 1 piping with B31.7 methodology to be appropriately dispositioned as 10 CFR 54.21(c)(1)(ii), the limits for the number of cycles that are being tracked by the Metal Fatigue of Reactor Vessel Coolant Pressure Boundary Program and the surveillance test procedure (STP) must be the 60-year projected cycles and not the 40-year design cycles. Furthermore, if the limits for the number of cycles being tracked are not the same as those used in the evaluation to disposition as 10 CFR 54.21(c)(1)(ii), then the evaluation is not valid for the period of extended operation. By letter dated February 22, 2010, the staff issued RAI 4.3.3-3 requesting that the applicant: (1) confirm that the limits for the number of cycles that will be tracked by its program are the same number of cycles that were used in the evaluation of 10 CFR 54.21(c)(1)(ii) and that these cycles will be incorporated into the UFSAR, and (2) if the limits that will be tracked by its program are not the same cycles that were to be used in the evaluation to disposition the Class 1 piping with B31.7 methodology as

10 CFR 54.21(c)(1)(ii), please justify the validity of this and clarify the action that is taken to ensure the CUF is below 1.0 during the period of extended operation.

In its response dated March 9, 2010, the applicant stated the 60-year design cycles in LRA Table 4.3-1 are the numbers that were used in the fatigue evaluations discussed in LRA Section 4.3.3. The applicant further stated that prior to the period of extended operation, the STP, which implements its Metal Fatigue of Reactor Vessel Coolant Pressure Boundary Program will be updated to reflect the 60-year design cycles in LRA Table 4.3-1. The applicant confirmed that the UFSAR will also be revised to reflect these 60-year design cycle limits. Therefore, the staff noted that the limits for the numbers of design cycles tracked by the STP will be the same as those used in the evaluations to disposition the Class 1 piping with B31.7 methodology and in the applicant’s UFSAR. The applicant stated that RAI 4.3.3-3, Part 2 is not applicable. The staff finds that RAI 4.3.3-3, Part 2 is not applicable because the limits for the number of cycles tracked by the STP will be the same as those used in the evaluations to disposition its Class 1 piping with B31.7 methodology.

Based on its review, the staff finds the applicant’s response to RAI 4.3.3-3 acceptable because: (1) the applicant confirmed the cycle limits that its STP and Metal Fatigue of Reactor Vessel Coolant Pressure Boundary Program will be monitoring against are the 60-year design cycle limits used in the fatigue evaluations to disposition its Class 1 piping with B31.7 methodology, and (2) the applicant stated that its STP and UFSAR will be revised to reflect the 60-year design cycle limits used in the fatigue evaluations. The staff’s concern described in RAI 4.3.3-3 is resolved

4.3.3.3 UFSAR Supplement

The applicant provided the UFSAR supplement summarizing the DAEC TLAA evaluation of fatigue of Class 1, 2, and 3 piping and components in LRA Section A.18.3.2.3. Based on its review of the UFSAR supplement, the staff concludes that the applicant provided an adequate summary description of its actions to address the fatigue evaluation from the fatigue of Class 1, 2, and 3 piping and components.

4.3.3.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses of Fatigue of Class 2, and 3 Piping and Components will remain valid during the period of extended operation. The staff also concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses of fatigue of Class 1 piping and components is projected to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.3.4 Effects of Reactor Coolant Environment (GSI 190)

4.3.4.1 Summary of Technical Information in the Application

In LRA Section 4.3.4, the applicant stated that it followed the GSI-190 guidance and performed environmental fatigue evaluations for locations applicable to DAEC in accordance with the guidance of NUREG/CR-6260. The applicant also stated that the older-vintage GE plant in

NUREG/CR-6260 is the appropriate comparison to DAEC since some of the original piping design at DAEC was in accordance with United States of America Standards (USAS) B31.1, as well as the fact that the older-vintage BWR in NUREG/CR-6260 was a BWR-4 plant, which is the same as DAEC.

From NUREG/CR-6260 for the older-vintage GE plant, the applicant identified the following locations for the environmental fatigue evaluation:

- RPV shell at lower head to shell transition
- RPV recirculation outlet nozzle
- RPV recirculation inlet nozzle
- RPV feedwater nozzle bore
- RPV core spray nozzle and safe end
- feedwater/RCIC tee
- recirculation piping/RHR return tee
- Class 1 RHR piping at tapered transition

The applicant stated that the environmental fatigue usage factor was calculated using the equation U_{env} = (U) (F_{en}), where U is the original fatigue usage, U_{env} is the environmentally assisted fatigue (EAF) usage factor, and F_{en} is environmental fatigue multiplier. The applicant also stated that it calculated F_{en} based on the guidelines shown in NUREG/CR-6583 (for carbon and low alloy steels) and NUREG/CR-5704 (for stainless steels).

The applicant stated that it performed the EAF calculations for the locations shown in LRA Table 4.3.4-1. The applicant also stated that, in its EAF evaluations, it assumed that the plant was under the hydrogen water chemistry (HWC) conditions for 72.4 percent of the time, and was under the normal water chemistry (NWC) conditions for 27.6 percent of the time, and the EAF calculations were based on the projected 60-year cycles. The applicant further stated that all six components of the stress tensor were used for the fatigue calculations. The applicant presented the EAF analysis results in LRA Table 4.3.4-1 and stated that the U_{env} values for all locations are less than 1.0.

The applicant stated that the Metal Fatigue of Reactor Coolant Pressure Boundary Program will monitor the numbers of cycles of the design transients and assure action is taken prior to any analyzed numbers of transients being exceeded. The applicant concluded that the Metal Fatigue of Reactor Coolant Pressure Boundary Program will manage the effects of aging due to EAF for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.3.4.2 Staff Evaluation

The staff reviewed LRA Section 4.3.4 to verify, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on components with intended functions will be adequately managed for the period of extended operation.

The staff noted that the first sentence of LRA Section 4.3.4 states that Generic Safety Issue (GSI)-166 was later renumbered as GSI-190. The staff further noted that GSI-190 was established to address the residual concerns of GSI-78 and GSI-166 regarding the environmental effects of fatigue on pressure boundary components for 60 years of plant operation and that GSI-190 is not a renumbered document of GSI-166. By letter dated

September 14, 2009, the staff issued RAI 4.3.4-1 requesting that the applicant correct the affected statement in the LRA.

In its response dated October 13, 2009, the applicant stated that the first sentence of LRA Section 4.3.4 will be replaced by the following:

> Generic Safety Issue (GSI) 190, "Fatigue Evaluation of Metal Components for 60-year Plant Life," was identified by the NRC because of concerns about the effects of reactor water environments on the fatigue life of components and piping during the period of extended operation.

Based on its review, the staff finds the applicant's response to RAI 4.3.4-1 acceptable because the applicant amended LRA Section 4.3.4 to appropriately characterize GSI-190. The staff's concern described in RAI 4.3.4-1 is resolved.

LRA Section 4.3.4 describes the environmental fatigue evaluation and the results are presented in LRA Table 4.3.4-1, including the F_{en} values determined for each component/location evaluated. The staff noted that, in LRA Section 4.3.4, the applicant stated, "Bounding F_{en} values are determined, or F_{en} values are computed for each load pair in the detailed fatigue calculation for each component." The applicant also stated, "HWC conditions were assumed to exist for 72.4% of the time, and NWC conditions to exist 27.6% of the time." The staff noted that F_{en} values depend on the material, strain rates, sulfur content, temperature, and the dissolved oxygen concentration of the reactor water. The staff noted that this information was not provided in the LRA. By letter dated September 14, 2009, the staff issued RAI 4.3.4-2 requesting the applicant to:

- Summarize its experience in control of dissolved oxygen level in the reactor water since the plant startup. Describe all water chemistry programs used, including procedures and requirements used for managing dissolved oxygen concentration as well as the inception date of each water chemistry program.

- Provide a historic summary of the dissolved oxygen level since plant startup. Estimate the fraction of time in its operating history thus far that the dissolved oxygen level exceeded 0.05 parts per million (ppm).

- Describe how reactor water samples were taken, including the sampling locations. If samples were taken from a single location, justify that the dissolved oxygen data discussed in Part 2 are applicable to all NUREG/CR-6260 locations for the F_{en} calculations.

- Specify the data of dissolved oxygen, strain rate, sulfur content, and temperature used for each load pair in the calculation of F_{en}.

- Provide the basis that supports the use of the condition that, "72.4% of the time the plant is under HWC chemistry condition and 27.6% of the time the plant is under the NWC chemistry condition."

- Explain how F_{en} is evaluated when the component has experienced different levels of dissolved oxygen concentration levels.

- Provide the reference document that was used for calculating F_{en} of nickel alloys.

In its response to RAI 4.3.4-2, Part 1, dated October 13, 2009, the applicant provided a historical outline of the water chemistry that has been used since initial plant startup. The applicant specifically provided the duration of each period (pre- and post-HWC, pre- and post-noble metal chemical additions (NMCAs)). The staff noted that the applicant has provided the chemistry programs that have been used and the inception date of these programs. The applicant stated that, prior to the use of HWC, samples were obtained by grab sample and the dissolved oxygen in the feedwater was lower than current values, and much higher in the reactor recirculation lines. The applicant stated that these values were confirmed by the HWC mini-test data taken in 1987.

Based on its review, the staff finds the applicant's response to RAI 4.3.4-2, Part 1, acceptable because: (1) the applicant provided a detailed history of the water chemistry regimes that were used, along with the duration of each regime, and (2) the applicant provided the water chemistry programs/guidelines and their inception dates. The staff's concern described in RAI 4.3.4-2, Part 1, is resolved.

In its response to RAI 4.3.4-2, Part 2, dated October 13, 2009, the applicant stated that from February 1974 through July 1987 (pre-HWC for 13.5 years) the dissolved oxygen level was 200 parts per billion (ppb) in the reactor. The applicant further stated that, from August 1987 through September 1996 (post-HWC/pre-NMCA during which H_2 was added at 6.0 standard cubic feet per minute (scfm) for 9.0 years), the dissolved oxygen level was 0.2 ppb in the reactor. The applicant stated from April 1996 through October 1996 (the HWC injection rate was temporarily increased to 15 scfm for 0.5 years) the dissolved oxygen level was 0.2 ppb in the reactor. The applicant further stated that from October 1996 through the present (post-NMCA at 6 scfm for 13.0 years) the dissolved oxygen level was 0.2 ppb in the reactor. The applicant stated that from February 1974 to October 1, 2009, it has been operating approximately 35.67-years including RFOs. The staff noted that for 13.5-years of the total 35.67-years, the applicant has operated at greater than 0.05 ppm of dissolved oxygen, which equates to approximately 37.8 percent. The staff also noted that since 1987, HWC system availability has exceeded 95 percent and the dissolved oxygen has been less than 0.05 ppm.

Based on its review, the staff finds the applicant's response to RAI 4.3.4-2, Part 2, acceptable because: (1) the applicant provided a detailed outline of is water chemistry operating history and the dissolved oxygen level in the reactor, and (2) the applicant calculated the approximate percentage that it has operated with a dissolved oxygen level greater than 0.05 ppm. The staff's concern described in RAI 4.3.4-2, Part 2, is resolved.

In its response to RAI 4.3.4-2, Part 3, dated October 13, 2009, the applicant provided a table which outlines the applicant's dissolved oxygen measurement locations. The applicant stated that the reactor recirculation line oxygen is typically 0.2 ppb, and it should be maintained less than 1 ppb which is in accordance with EPRI BWR Water Chemistry Guidelines. The applicant described the configuration in which dissolved oxygen is measured off a ¾-inch line tapped from the "B" reactor recirculation riser header. The applicant further described that the dissolved oxygen is measured continuously, the information is recorded, and there is an annunciator that is activated if dissolved oxygen is greater than 5 ppb, increasing. The applicant stated that the upper RPV area, RPV beltline, and RPV bottom head region dissolved oxygen levels were calculated using the BWRVIA Radiolysis model, which is a software tool that was developed by EPRI to predict electrochemical corrosion potential and H_2/O_2 molar ratio values for various reactor coolant components. The applicant clarified that because the reactor water has been treated with noble metals, the H_2/O_2 molar ratio is the parameter of interest. The applicant stated that maintaining an H_2/O_2 molar ratio greater than or equal to 2 shows mitigation of cracking, that a ratio greater than or equal to 3 is required by EPRI guidance to provide sufficient margin, and that its H_2/O_2 molar ratio is typically maintained at 4. The applicant also stated that the measure of dissolved oxygen is performed continuously in the feedwater line and the sample is taken from the high pressure feedwater heater outlet by a digital meter. The staff noted that the applicant has described its method for sampling dissolved oxygen for its plant-specific NUREG/CR-6260 components/locations, specifically the recirculation line, feedwater line, upper RPV area, RPV beltline, and RPV bottom head region.

Based on its review, the staff finds the applicant's response to RAI 4.3.4-2, Part 3, acceptable because: (1) the applicant described its method for sampling dissolved oxygen for its plant-specific NUREG/CR-6260 components/locations and (2) the applicant continuously monitors the dissolved oxygen in the recirculation and feedwater lines and maintains significant margin in the H_2/O_2 molar ratio for the upper RPV area, RPV beltline, and RPV bottom head region. The staff's concern described in RAI 4.3.4-2, Part 3, is resolved.

In its response to RAI 4.3.4-2, Part 5, dated October 13, 2009, the applicant stated in order to perform the environmental fatigue evaluations, HWC conditions were assumed to exist for 72.4 percent of the time, and normal water chemistry (NWC) conditions to exist for 27.6 percent of the time. The applicant provided the following method for calculating overall HWC availability: [(T1 * 0) + (T2 * A1) + (T3 * A2)]/[(T1 + T2 + T3)], where A1 = 90 percent (HWC availability since HWC implementation), A2 = 95 percent (HWC availability for future operation), T1 is time at pre-HWC conditions (13.35 years), T2 is time since HWC implementation (17.25 years) and T3 is future time for HWC operation (29.40 years). The staff finds the applicant's method for determining overall HWC availability reasonable because the considered plant-specific operating experience for its past and present HWC availability and has considered a practical future HWC availability.

Based on its review, the staff finds the applicant's response to RAI 4.3.4-2, Part 5, acceptable because: (1) the applicant provided an adequate calculation for the statement "72.4% of the time the plant is under HWC chemistry condition and 27.6% of the time the plant is under the NWC chemistry condition" and (2) the applicant provided an adequate method for determining overall HWC availability as described above. The staff's concern described in RAI 4.3.4-2, Part 5, is resolved.

In its response to RAI 4.3.4-2, Parts 4 and 6, dated October 13, 2009, the applicant provided its methodology for calculating the F_{en} factor for each location corresponding to the NUREG/CR-6260 locations. The staff noted that the applicant used NUREG/CR-5704 for determining the F_{en} factor for stainless steels and NUREG/CR-6583 for determining the F_{en} factor for carbon steels and low alloy steels, as recommended by GALL AMP X.M1. The staff noted that the applicant used a constant F_{en} factor of 1.49 for its nickel alloy components. The staff noted that the applicant calculated its F_{en} factors by incorporating its plant operation with HWC and NWC and considered its overall HWC availability. In its response to Part 7, the applicant stated that the use of a constant F_{en} factor of 1.49 for nickel alloys was based on a methodology from 1995/1996. The staff noted that the assumed 72.4 percent overall HWC availability has an effect on the environmental CUF values since they may fluctuate based on actual plant operations during the period of extended operation. The staff further noted that RG 1.207, "Guidelines for Evaluating Fatigue Analyses Incorporating the Life Reduction of Metal Components Due to the Effects of the Light-Water Reactor Environment for New Reactors," based on NUREG/CR-6909, which incorporates more recent fatigue data for determining the F_{en} factor for nickel alloys was issued in 2007. By letter, dated February 22, 2010, the staff issued RAI 4.3.4-3 requesting that the applicant: (1) clarify if the value of 1.49 for the F_{en} factor is the bounding or conservative value for the Alloy 600 and SB166 components as compared to the values calculated from NUREG/CR-6909 for nickel alloys and, if not, please justify the use of the a F_{en} factor of 1.49 for the Alloy 600 and SB166 components; (2) describe the planned actions to update the CUF calculations with F_{en} factor for Alloy 600 and SB166 components consistent with the methodology in NUREG/CR-6909 or other acceptable methods; and (3) describe how the assumed 72.4 percent overall HWC availability will be accounted for when managing all NUREG/CR-6260 locations, since this overall HWC availability has an effect on the environmental CUF values and may fluctuate based on actual plant operations during the period of extended operation.

In its response dated March 9, 2010 the applicant stated the value of 1.49 for F_{en} for Alloy *600/SB* 166 components is less than the value that would be calculated from NUREG/CR-6909 for nickel alloys and a review indicates that using NUREG-6909 methodology would result in a value of Fen of 3.31. The applicant stated that this calculation was based on a temperature of 546^{o}F, and maximum values for ε' and O' from NUREG/CR-6909. The applicant provided the following relationship to account for overall HWC availability:

Overall Fen = 0.72425*Fen HWC + (1-0.72425)*Fen NWC

Overall Fen = 0.72425*(3.77) + (1-0.72425)*(2.11) = 3.31

The staff finds the F_{en} value calculated by the applicant is reasonable because (1) the bounding values for ε' and O' from NUREG/CR-6909 were utilized, (2) the applicant accounted for past, present and future HWC availability and (3) the temperature value used does not exceed the temperature experienced by these components. The applicant stated that there are no current plans to update the CUF calculations with a F_{en} factor for Alloy 600 and SB166 components consistent with the methodology in NUREG/CR-6909.

The applicant also stated that the Metal Fatigue of Reactor Coolant Pressure Boundary Program will ensure that HWC availability is monitored to ensure that the assumptions in the environmental fatigue evaluations remain valid. The applicant further stated as a part of the existing Commitment No. 35, the Reactor Vessel Transient Design Cycles STP (which implements the program) will be revised to refer to its Chemistry Strategic Plan.

On April 6, 2010 the staff held a teleconference call with the applicant to discuss its response to RAI 4.3.4-3, Part 2, in relation to not updating its CUF calculations with a F_{en} factor for Alloy 600 and SB166 components consistent with the methodology in NUREG/CR-6909. By letter dated April 28, 2010 the applicant supplemented its response to RAI 4.3.4-3, Part 2 by stating that the numbers of vessel thermal and pressure transient cycles are tracked with its STP that is performed on a cyclic basis. The applicant stated that cycles that are inputs to the vessel fatigue evaluations are manually counted to ensure that the actual numbers of these cycles are less than the numbers used to determine the usage factors. Thus, this ensures that the usage factors remain below the calculated values and that design limits on fatigue usage are not exceeded. The applicant stated if the number of transient cycles approaches the number of cycles used in the fatigue calculation, the fatigue calculation would be evaluated and revised as needed. The applicant stated that the recirculation inlet nozzle safe end, feedwater nozzle safe end, and core spray nozzle safe end are nickel alloy components and in the future, if the environmental fatigue calculations for these three safe ends are revised or updated, the F_{en} data for nickel alloy from the methodology that is described in NUREG/CR-6909 will be used in the determination of usage factors. The applicant committed (Commitment No.51) to utilize the F_{en} data for nickel alloy from the methodology described in NUREG/CR-6909 for its recirculation inlet nozzle safe end, feedwater nozzle safe end, and core spray nozzle safe end for future revisions or updates to the environmental fatigue calculations.

The staff finds it acceptable that the applicant will utilize the methodology in NUREG/CR-6909 in future revisions or updates to the environmental fatigue calculations acceptable because (1) the applicant counts the number of transient cycles and compares it to the inputs used in the vessel fatigue evaluations to ensure that the actual cycles are less than those used to determine the usage factors, which are currently below the design limit of 1.0 and (2) if the value of 3.31 calculated by the applicant in accordance with the methodology in NUREG/CR-6909 is used to calculate the 60-year environmental CUFs for the Alloy *600/SB166* locations, the CUF values would still remain below the design limit of 1.0.

Based on its review, the staff finds the applicant's response to RAI 4.3.4-3,as supplemented by letter dated April 28, 2010, acceptable because (1) the applicant calculated the F_{en} factor for its Alloy 600 and SB166 components in accordance with NUREG/CR-6909, (2) the applicant confirmed that monitoring of HWC availability will ensure the assumptions in the environmental fatigue evaluations will remain valid and that as a part of Commitment No. 35, the STP will be revised to refer to its Chemistry Strategic Plan, (3) the 60-year environmental CUFs for these nickel alloy components are currently below the design limit of 1.0 and would still remain below the design limit of 1.0 if the F_{en} value for nickel alloys calculated based on the methodology in NUREG/CR-6909 is utilized and (4) the effects of aging for these Alloy 600 and SB166 components will be managed by the applicant's Metal Fatigue of Reactor Coolant Pressure Boundary Program, that will monitor the number of cycles that were used in the applicant's 60-year CUF calculations, such that corrective actions are taken prior to any analyzed number of transients being exceeded and prior to the 60-year environmental CUF exceeding the design limit of 1.0. The staff's concern described in RAI 4.3.4-3 is resolved.

4.3.4.3 UFSAR Supplement

The applicant provided the UFSAR supplement summarizing its TLAA evaluation of effects of reactor coolant environment in LRA Section A.18.3.2.4. Based on its review of the UFSAR supplement, the staff concludes that the applicant provided an adequate summary description of its actions to address the fatigue evaluation of the effects of reactor coolant environment.

4.3.4.4 Conclusion

On the basis of its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging due to fatigue on the intended functions of the effects of reactor coolant environment will be adequately managed during the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.4 Environmental Qualification of Electrical Equipment

The 10 CFR 50.49 EQ program is a TLAA for purposes of license renewal. The TLAA of the EQ of electrical components includes all long-lived, passive, and active electrical and instrumentation and control (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 purpose), 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 function(s) will be adequately managed for the period of extended operation.

4.4.1 Summary of Technical Information in the Application

LRA Section 4.4, "Environmental Qualification of Electrical Equipment (EQ)," summarizes the applicant's evaluation for EQ of plant electrical and I&C components for the period of extended operation. The DAEC EQ Program is an existing program established to meet commitments for 10 CFR 50.49. The applicant stated that the DAEC

Environmental Qualification (EQ) Program is consistent with GALL AMP XI.E1, "Environmental Qualification (EQ) of Electrical Components." The applicant also stated that EQ programs manage component thermal, radiation, and cyclical aging based on 10 CFR 50.49(f) qualification methods. The applicant also stated that environmentally qualified components not qualified for the current license term are to be refurbished, replaced, or have their qualification extended prior to reaching the aging limits established in the evaluation. The applicant further stated that aging evaluations of electrical components in the EQ program that specify a qualified life of at least 40 years are considered TLAAs.

The applicant incorporated TLAA option 10 CFR 54.21(c)(1)(iii). The applicant stated that reanalysis of an aging evaluation to extend the qualification of components under 10 CFR 50.49(e) is performed on a routine basis as part of an EQ program. The applicant also stated that important attributes for the reanalysis of an aging evaluation include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions (if acceptance criteria are not met). The applicant concluded that the effects of aging on the intended functions will be adequately managed for the period of extended operation.

4.4.2 Staff Evaluation

The staff reviewed LRA Section 4.4, program basis documents, and interviewed plant personnel to determine if the applicant's EQ Program meets the requirement of 10 CFR 54.21(c)(1). The applicant's EQ Program is implemented per the requirements of 10 CFR 54.21(c)(1)(iii) to show that components evaluated under the applicant's TLAA evaluation will be adequately managed during the period of extended operation. The staff reviewed the applicant's EQ Program conformance to the requirements of 10 CFR 50.49, including the management of aging effects, to confirm that electric equipment requiring EQ will continue to operate consistent with the CLB during the period of extended operation.

The staff also conducted a review of the information provided in LRA Sections 4.4 and B.4.1, and program basis documents provided to the staff during the audit. Based on the staff's review of LRA Sections 4.4 and B.4.1, including audit results, the staff concludes that the applicant's EQ Program elements are consistent with GALL AMP X.E1.

Therefore, the staff finds that the applicant's EQ Program demonstrates, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation. The applicant's EQ Program is, therefore, capable of managing the qualified life of components within the scope of license renewal, 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 UFSAR Supplement

In LRA Appendix A, Section 18.3.3.1, the applicant provided the UFSAR supplement summary description for the TLAA evaluation of the EQ of electric equipment. On the basis of its review, the staff concludes that the information in the UFSAR supplement is consistent with GALL AMP X.E1 and SRP-LR Table 4.4-2.

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

4.4.4 Conclusion

On the basis of its review of the applicant's EQ 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 pursuant to 10 CFR 54.21(c)(1)(iii) for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the UFSAR supplement and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

4.5 <u>Concrete Containment Tendon Prestress</u>

4.5.1 Summary of Technical Information in the Application

LRA Section 4.5 summarizes the evaluation of concrete containment tendon pre-stress for the period of extended operation. DAEC does not have a concrete containment with pre-stressed tendons; therefore, tendon pre-stress evaluations are not applicable.

4.5.2 Staff Evaluation

DAEC containment has no pre-stressed tendons; therefore, the staff finds that this TLAA is not required.

4.5.3 UFSAR Supplement

The staff concludes that no UFSAR supplement is required because DAEC has no pre-stressed tendons in the containment building.

4.5.4 Conclusion

On the basis of its review, as discussed above, the staff concludes that this TLAA is not required.

4.6 Fatigue of Primary Containment, Piping, and Components

The applicant stated in Section 4.6 that the DAEC containment vessel is a Mark I design in accordance with the ASME Code, Section III. Subsequently, during large scale testing for the Mark III containment system and the in-plant testing for Mark I primary containment systems, new suppression chamber hydrodynamic loads were identified. These loads result from blow-down into the suppression chamber during a postulated LOCA and during safety relief valve (SRV) operation for plant transients. The applicant also stated that the Mark I analyses are detailed in the DAEC Plant Unique Analysis Report (PUAR) and assume 60 multiple SRV lifts and 740 single SRV lifts. The applicant further stated that a projected number of 334 single SRV lifts for 60 years, and a projected number of 42 multiple lifts for 60 years. Both of these numbers are below the values assumed in the Mark I analyses (740 single SRV lifts and 60 multiple SRV lifts).

The staff reviewed LRA Section 4.6 to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation. However, the staff was unable to verify the actual number of SRV lifts from 1974 to 2007, during the analyses that were performed in 2007. The staff determined that additional information was required to complete its review. By letter, dated February 22, 2010, the staff issued RAI 4.6-1 requesting the applicant provide the missing information above and to explain how the SRV lifts will be monitored during the period of extended operation since the number of SRV lifts were not tracked until 2007.

In a letter dated March 9, 2010, the applicant stated that from 1974 until the beginning of 2007, the numbers of SRV lifts which have occurred from normal operating conditions (including the 10 percent factor for conservatism) are: 219 single SRV lifts and 33 multiple SRV lifts. The applicant also stated that the Reactor Vessel Transient Design Cycles STP was revised to establish new requirements for monitoring SRV lifts and to incorporate the above totals of SRV lifts accumulated to date.

The staff reviewed the applicant’s responses to the RAI and finds it acceptable because the total projected number of single SRV lifts and multiple SRV lifts was less than the Mark I analyses that are detailed in the DAEC PUAR, and the Reactor Vessel Transient Design Cycles STP was revised to establish new requirements for monitoring SRV lifts. Therefore, the staff's concern described in RAI 4.6-1 is resolved.

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of fatigue analyses of the primary containment piping, and components in LRA Sections 18.3.4. Based on its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address the fatigue analyses of primary containment piping and components is adequate, because the applicant has provided information equivalent to the guidance found in SRP-LR Table 4.6-1.

Based on its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation and found that the fatigue of the primary containment piping and components are in accordance with 10 CFR 54.21(c)(1)(ii). The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d), and; is therefore, acceptable.

4.6.1 Fatigue Analysis of Suppression Chamber

4.6.1.1 Summary of Technical Information in the Application

The applicant stated in Section 4.6.1 of the DAEC plant unique analysis report (PUAR), that the fatigue usage factors for the controlling suppression chamber component and weld are:

- NOC+SBA: CUF =0.226 (weld)
- NOC+IBA: CUF =0.356 (torus shell)
- NOC+IBA: CUF =0.195 (weld)
- Where NOC=normal operating conditions, SBA=small break accident, and
- IBA=intermediate break accident.

The applicant also stated that the maximum CUF (for 40 years) for the torus shell and welds is 0.467. Multiplying this value by 60/40 results in a CUF (for 60 years) of 0.70, which is less than 1.0.

4.6.1.2 Staff Evaluation

The staff reviewed LRA Section 4.6.1 to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation. However, the staff was unable to verify the actual number of thermal cycles the suppression chamber (torus) has experienced until now. The staff determined that additional information was required to complete its review. By letter, dated February 22, 2010, the staff issued RAI 4.6-2 requesting that the applicant explain how the numbers of thermal cycles are monitored for suppression chamber, and actual count of thermal cycles the suppression chamber has experienced.

In a letter dated March 09, 2010, the applicant stated that the fatigue analysis of the suppression chamber is based on a defined number of single and multiple SRV lifts from normal operating condition (NOC) and one small-break or intermediate-break accident. The applicant also stated that the CUF contribution from SRV lifts and the CUF contribution from the accident are added up to derive the maximum CUF for the suppression chamber. The applicant further stated that the suppression chamber cycles are monitored via the Reactor Vessel Transient Design Cycles STP.

The staff reviewed the applicant's responses to the RAI and finds them acceptable, because, the suppression chamber cycles are monitored via the Reactor Vessel Transient Design Cycles STP; therefore, the staff's concern described in RAI 4.6-2 is resolved.

4.6.1.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of fatigue analyses of the suppression chamber in LRA Sections 18.3.4.1. Based on its review of the UFSAR supplement, and since the applicant has provided information equivalent to the guidance found in SRP-LR Table 4.6-1, the staff concludes that the summary description of the applicant's actions to address the fatigue analyses of the suppression chamber is adequate.

4.6.1.4 Conclusion

Based on its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation and found that the fatigue of the suppression chamber is in accordance with 10 CFR 54.21(c)(1)(ii). The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d), and is, therefore, acceptable.

4.6.2 Fatigue Analysis of the Vent System and Vent Line Bellows

4.6.2.1 Summary of Technical Information in the Application

The applicant stated in Section 4.6.2 of the DAEC Plant Unique Analysis Report (PUAR), that the maximum fatigue usage factors for the Vent System Components and Welds are:

- NOC+SBA: CUF = 0.12 (Vent Header)
- NOC+SBA: CUF = 0.33 (Weld)
- NOC+IBA: CUF = 0.12 (Vent Header)
- NOC+IBA: CUF = 0.33 (Weld)

Therefore, the maximum CUF (for 60 years) is 0.50 (0.33 x 60/40).

The applicant also stated that the vent lines bellows, thermal load is the largest contributor to displacements. The PUAR specifies 150 thermal load cycles. Multiplying by 60/40, results in 225 cycles and rated capacity is 500 cycles; this remains adequate for fatigue.

4.6.2.2 Staff Evaluation

The staff reviewed LRA Section 4.6.2 to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation. However, the staff was unable to verify the actual number of thermal cycles the bellow has experienced up to now. The staff determined that additional information was required to complete its review. By letter dated February 22, 2010, the staff issued RAI 4.6-3 requesting that the applicant explain how the numbers of thermal cycles are monitored for the containment bellows and the actual count of thermal cycles the bellows have experienced.

In a letter dated March 09, 2010, the applicant stated that there is no significant non-accident source of normal cyclic thermal loads on the containment vessel and bellows beyond those that would be generally associated with startup or shutdown of the reactor and those associated with SRV lifts. The applicant also stated that the reactor startup and shutdown cycles are recorded and tracked via the “Reactor Vessel Transient Design Cycles” STP, which monitors the number of accumulated transient cycles for the metal fatigue of reactor coolant pressure boundary program. The applicant further stated that the number of cycles accumulated after approximately 30 years of operation and the number projected for 60 years are provided in LRA Table 4.3-1.

The staff reviewed the applicant’s responses to the RAI and finds it acceptable, because the number of accumulated transient cycles are captured and monitored under “Reactor Vessel Transient Design Cycles” STP. Also, the number of cycles accumulated after approximately 30 years of operation and the number projected for 60 years are provided in LRA Table 4.3-1. Therefore, the staff’s concern described in RAI 4.6-4 is resolved.

4.6.2.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of fatigue analyses of the vent system and vent line bellows in LRA Sections 18.3.4.2. Based on its review of the UFSAR supplement, and because the applicant has provided information equivalent to the guidance found in SRP-LR Table 4.6-1, the staff concludes that the summary description of the applicant’s actions to address the fatigue analyses of the vent system and vent line bellows is adequate.

4.6.2.4 Conclusion

Based on its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation and found that the fatigue of the vent system and vent line bellows is in accordance with 10 CFR 54.21(c)(1)(ii). The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d), and is, therefore, acceptable.

4.6.3 Fatigue Analysis of Suppression Chamber External Piping and Penetrations

4.6.3.1 Summary of Technical Information in the Application

The applicant stated in Section 4.6.3 that the large and small bore torus attached piping (TAP) and suppression chamber penetrations fatigue analyses were completed that were based on cycles postulated to occur within the 40-year operating life of the plant. The applicant also stated that the Mark I Owners Group prepared and submitted a generic fatigue evaluation report to the NRC in late 1982. The report addressed fatigue on a generic basis, and reported cumulative usage factors below 0.5. The applicant further stated that the PUAR concludes that the 40-year CUFs for the controlling components are also less than the acceptable fatigue usage value of 1.0. As discussed previously, 334 single SRV lifts are projected for 60 years, and 42 multiple lifts are projected for 60 years. Both of these numbers are well below the values assumed in the Mark I analyses (740 single SRV lifts and 60 multiple SRV lifts). Therefore, the analyses for the penetrations remain valid for 60 years.

4.6.3.2 Staff Evaluation

The staff reviewed LRA Section 4.6.3 to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation. However, the staff was unable to verify the actual number of thermal cycles the suppression chamber external piping and penetrations have experienced until now. The staff determined that additional information was required to complete its review. By letter dated February 22, 2010, the staff issued RAI 4.6-4 requesting that the applicant explain how the number of thermal cycles are monitored for the suppression chamber external piping and penetrations, and the actual count of thermal cycles the suppression chamber external piping and penetrations have experienced, along with the actual number of SRV lifts between 1974 through 2007 that were used to project the SRV lifts through the period of extended operation.

In a letter dated March 09, 2010, the applicant stated that there is no significant non-accident source of normal cyclic thermal loads on the containment vessel and bellows beyond those that would be generally associated with starup or shutdown of the reactor and those associated with SRV lifts. The applicant also stated that the number of SRV lifts which have occurred from normal operating conditions (including the 10 percent factor for conservatism) are: 219 single SRV lifts and 33 multiple SRV lifts. The applicant also stated that the Reactor Vessel Transient Design Cycles STP was revised to establish new requirements for monitoring SRV lifts and to incorporate the above totals of SRV lifts accumulated to date. The applicant further stated that the number of cycles accumulated after approximately 30 years of operation, and the number projected for 60 years, are provided in LRA Table 4.3-1.

The staff reviewed the applicant’s response to the RAI and finds it acceptable because, the number of accumulated transient cycles are captured and monitored under “Reactor Vessel Transient Design Cycles” STP; additionally, the number of cycles accumulated after approximately 30 years of operation and the number projected for 60 years are provided in LRA Table 4.3-1. Therefore, the staff’s concern described in RAI 4.6-4 is resolved.

4.6.3.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of fatigue analyses of suppression chamber external piping and penetrations in LRA Sections 18.3.4.3. Based on its review of the UFSAR supplement, and because the applicant has provided information equivalent to the guidance found in SRP-LR Table 4.6-1, the staff concludes that the summary description of the applicant’s actions to address the fatigue analyses of the suppression chamber external piping and penetrations are adequate.

4.6.3.4 Conclusion

Based on its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation and found that the fatigue of the suppression chamber external piping and penetrations is in accordance with 10 CFR 54.21(c)(1)(ii). The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d), and is, therefore, acceptable.

4.6.4 Fatigue Analysis of Containment Vessel

4.6.4.1 Summary of Technical Information in the Application

The applicant stated in Section 4.6.4 that the DAEC containment stress report includes an evaluation performed in accordance with Section III of the ASME Code, paragraph N-415.1, to determine whether a fatigue analysis is required for the containment vessel. The report concludes that the containment satisfies the ASME Code, Section III, Paragraph N-415.1. The applicant also stated that the evaluation assumes a maximum temperature fluctuation of approximately 50°F and approximately 100 load fluctuations. The applicant further stated that while the evaluation does not state that the 100 load fluctuations correspond to the number of startups, it does state that the range of pressure fluctuation is plus or minus 2 psi. Therefore, the evaluation was reviewed to determine if it was still valid for the increased number of startups for a 60-year life, that is 212 (176 startups plus 36 “aborted” startups). The review determined that the conclusion of the evaluation remained valid, so that an analysis for cyclic operation is not required.

4.6.4.2 Staff Evaluation

The staff reviewed LRA Section 4.6.4 to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation. However, since the staff was unable to verify the actual number of load fluctuations for 40 years of operation, the staff determined that additional information was required to complete its review. By letter dated February 22, 2010, the staff issued RAI 4.6-5 requesting that the applicant: (1)explain why an assumed number of load fluctuations is used instead of the actual number experienced by the containment vessel, and (2) provide the basis that has been used in the stress report to determine that the containment vessel is exempt for fatigue analysis.

In a letter dated March 09, 2010, the applicant stated that the actual number of load fluctuations at DAEC was used to determine the projected value for 60 years of operation. The relationship used to project the transient counts forward to 60 years is provided in the DAEC responses to RAI 4.3.1-2 in a letter, dated October 13, 2009. The number of cycles determined by this projection is used to demonstrate that the containment vessel remains exempt from fatigue analysis for 60 years of operation. The applicant also stated that general information regarding fatigue exemptions in accordance with the ASME Code Section III Paragraph N-415.1 is provided in the DAEC response to RAI 4.3.1-1 in the letter dated October 13, 2009. As discussed in that response, if certain requirements outlined in Paragraph N-415.1 are met, a fatigue analysis is not required.

The staff reviewed the applicant's response to the RAI and find it acceptable because the relationship used to project the transient counts forward to 60 years is provided in the DAEC responses to RAI 4.3.1-1 and RAI 4.3.1-2 by letter dated October 13, 2009. In addition, the applicant has provided the general information regarding fatigue exemptions in accordance with the ASME Code section III Paragraph N-415.1. Therefore, the staff's concern described in RAI 4.6-5 is resolved.

4.6.4.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of stress report-containment vessel design calculations in LRA Sections 18.3.4.4. Based on its review of the UFSAR supplement and the staff concludes that the summary description of the applicant's actions to address the stress report-containment vessel design calculations are adequate because the applicant has provided information equivalent to the guidance found in SRP-LR Table 4.6-1.

4.6.4.4 Conclusion

Based on its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the effects of aging on the components intended functions will be adequately managed for the period of extended operation, and that the stress report-containment vessel design calculations are in accordance with 10 CFR 54.21(c)(1)(ii). The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d), and is, therefore, acceptable.

4.6.5 *Design Analyses of Flued Heads for Class 1 Penetrations*

4.6.5.1 Summary of Technical Information in the Application

The applicant stated in Section 4.6.5 that the design analyses of Class 1 flued heads are performed according to Article NB-3000 of the ASME Code, Section III, Nuclear Power Plant Components, 1971 edition, and the Design Specification. The applicant also stated that the analyses consist of a determination and evaluation of the maximum stress intensities which various loads or load combinations induce in the heads and immediately-adjacent pipe sections. The applicant further stated that acceptability of the flued heads is demonstrated by comparing the maximum stress intensity and allowable stress for various load combinations and conditions. One of the "Normal and Upset" evaluations includes a cycle assumption (allowable stress is based on an assumed number of cycles). The allowable stress ($2S_a$ corresponding to the assumed number of cycles) is compared to the maximum stress intensity.

4.6.5.2 Staff Evaluation

The staff reviewed LRA Section 4.6.5 to verify, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation. However, the staff was unable to verify the adequacy of the flued heads penetrations that was determined by comparing allowable stresses, based on assumed number of cycles and maximum stress intensities. The staff determined that additional information was required to complete its review. By letter dated February 22, 2010, the staff issued RAI 4.6-6 requesting that the applicant explain why an assumed number of cycles instead of actual number of cycles tracked since the start of plant operation, were used to project the results for 60 years of operation.

In a letter dated March 09, 2010, the applicant stated that an assumed number of cycles is used since DAEC does not count cycles on flued heads individually. The assumed numbers of cycles on the flued heads is based on the number of reactor vessel transient cycles assumed to occur. The applicant also stated that conservatism in this assessment is that the total number of reactor vessel design cycles in 60 years, as reported in LRA Table 4.3-1, is actually smaller than the 40 year total, and the cycles experienced by the flued heads are based on the number of vessel cycles. The applicant further stated that increasing the 40-year number of normal and upset design cycles for the flued heads by multiplying the total by 1.5 to account for 60 years is conservative.

The staff reviewed the applicant's response to the RAI and finds it acceptable as long as the number of reactor vessel transient cycles remains at or below those listed in LRA Table 4.3-1, the cycle on the flued heads will remain within acceptance criteria. In addition, the reactor vessel transient cycles are tracked by the Reactor Vessel Transient Design Cycles STP. Therefore, the staff's concern described in RAI 4.6-6 is resolved.

4.6.5.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of the design analyses of flued heads for class 1 penetrations in LRA Sections 18.3.4.5. Based on its review of the UFSAR supplement, the staff concludes that the summary description of the applicant's actions to address the design analyses of flued heads for class 1 penetrations is adequate, because the applicant has provided information equivalent to the guidance found in SRP-LR Table 4.6-1.

4.6.5.4 Conclusion

Based on its review, as discussed above, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation and found that the design analyses of flued heads for Class 1 penetrations are in accordance with 10 CFR 54.21(c)(1)(ii). The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d), and is, therefore, acceptable.

4.7 <u>Other Plant-Specific Time-Limited Aging Analyses</u>

LRA Section 4.7 summarizes the evaluation of the following plant-specific TLAAs:

- cranes – reactor and turbine building
- evaluation of the fatigue life of the stabilizer assembly
- evaluation of existing HCC-B002 “dollar weld” indication
- evaluation of thermal fatigue effects on steam lead and inlet to RPV
- control rod drive mechanism (CRDM) fatigue
- main steam isolation valve (MSIV) “D” flaw evaluation

- bellows design analysis

4.7.1 Cranes – Reactor and Turbine Building

4.7.1.1 Summary of Technical Information in the Application

In LRA Section 4.7.1, the applicant stated that the turbine building crane and reactor building crane specifications assume a 40-year useful life for fatigue stress analysis purposes. The applicant also stated that according to the specification, the maximum usage of each component at rated load and full speed shall be taken as a minimum of 1 percent of the 40-year useful life. The applicant further stated that the actual operating time at less than rated will average less than 1,000 hours per year.

The applicant stated that the reactor building crane is designed to Crane Manufacturers Association of America (CMAA) Class A. The applicant also stated that there are implicit cycle requirements for cranes designed in accordance with CMAA-70 and the cycle limit for Class A CMAA-70 cranes is 20,000 to 200,000 cycles.

The applicant stated that the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program will adequately manage the effects of aging on intended functions for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.7.1.2 Staff Evaluation

The staff reviewed LRA Section 4.7.1, pursuant to 10 CFR 54.21(c)(1)(iii), to verify that the analyses remain valid for the period of extended operation.

Based on its review, the staff finds that the applicant presented two methods to limit the usage of the cranes. The staff noted that the first is based on the actual duty time (hours) of the cranes as they perform the services and the second is to count the number of cycles that the cranes incur while performing the services. The staff also noted that for the duty time method, the limit is 3,504 hours (1 percent of 40 years x 365 x 24) when the cranes operated at the rated load and full speed. The applicant further stated that the actual operating time at less than rated loading will average less than 1,000 hours per year. The applicant stated that for the cycle counting method, the total number of lifts permitted is 20,000 cycles. The staff noted that this may be considered as the cycle limit through the first renewed license term, 60 years.

The staff noted that the applicant could have tracked the cranes usage, projected to 60 years, and determine the most suitable disposition category for this TLAA. However, the applicant dispositioned its TLAA in accordance with 10 CFR 54.21(c)(1)(iii), so that its Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program will adequately manage the effects of aging on intended functions for the period of extended operation. The staff finds the applicant’s use of the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program acceptable, because it will record and evaluate the effects of past and future usage on the cranes.

4.7.1.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of the cranes in LRA Section A.18.3.5.1. On the basis of its review of the UFSAR supplement, the staff concluded that the summary description of the applicant's actions to address the crane lifting cycle limit issue is adequate.

4.7.1.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging due to fatigue on the intended functions of the cranes will be adequately managed during the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.2 Evaluation of the Fatigue Life of the Stabilizer Assembly

4.7.2.1 Summary of Technical Information in the Application

In LRA Section 4.7.2, the applicant stated that lateral loads from the vessel stabilizers and shield wall are transmitted to the drywell stabilizers by rigid struts extending from the top of the shield wall to the drywell stabilizers. This is also discussed in UFSAR Section 5.3.3.2.3.

The applicant stated that it has performed a fatigue evaluation of the stabilizer assembly to support a reportability determination. The applicant also stated that the analysis was aimed at the stabilizer at elevation 816'-3" between the bioshield wall and the containment to determine the effects due to relative thermal growth between these two components. The applicant stated that the analysis indicated the possibility of a maximum differential vertical growth of 0.31 inches during startup between the bioshield and containment, and a peak-to-peak displacement of 0.45 inches during the entire startup/shutdown cycle.

The applicant further stated that, based on the analysis, the fatigue life of the stabilizer assembly due to relative thermal movement of the attached structure is approximately 4,750 cycles. The applicant also stated that it performed a lower bound fatigue life estimate. The applicant stated that the lower bound analysis incorporated a significant stress concentration factor (SCF) of 4 for fillet welds, and the fatigue usage was calculated based on the ASME design curve. The applicant thus determined that the pipe is adequate to sustain at least 400 cycles.

The applicant concluded that since 400 cycles is larger than the number of startup cycles assumed for 60 years, 212 (176 startups + 36 "Aborted" startups), the analysis has been projected through the period of extended operation and the aging effect is managed in accordance with 10 CFR 54.21(c)(1)(ii).

4.7.2.2 Staff Evaluation

The staff reviewed LRA Section 4.7.2, pursuant to 10 CFR 54.21(c)(1)(ii), to verify that the TLAA is projected to the end of the period of extended operation.

Based on its review, the staff found that the applicant's disposition of this TLAA, in accordance with 10 CFR 54.21(c)(1)(ii), acceptable because the 60-year assumed startup cycles is well below the allowable cycles determined in the lower bound analysis. The staff noted that both the lower bound cycles (400) and the 60-year startup cycles (212) used for the projection calculation are conservative. The staff noted that this is reasonable because 400 cycles represents the number of cycles the pipe can endure under the worst loading conditions, whereas the 212 cycles is a generous estimate of cycles that the pipe might actually experience over 60 years of plant operation and may not be the worst loading conditions. The staff also noted that the applicant's projections for 60 years are only approimately half the startup cycles.

4.7.2.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of the fatigue life of the stabilizer assembly in LRA Section A.18.3.5.2. On the basis of its review of the UFSAR supplement, the staff concluded that the summary description of the applicant's actions to address the fatigue life of the stabilizer assembly is adequate.

4.7.2.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses of the fatigue life of the stabilizer assembly is projected to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.3 Evaluation of Existing HCC-B002 "Dollar Weld" Indication

4.7.3.1 Summary of Technical Information in the Application

LRA Section 4.7.3 states that during RFO 17, inspections identified an indication in a circumferential weld in the reactor head (Vessel Head Dollar Weld HCC-B002) that did not meet the ASME Code Section XI IWB-3500 acceptance standards. The applicant evaluated the indication and determined that it was acceptable to leave it as is per Section XI IWB-3600.

The applicant further stated that per BWRVIP-74-A-BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal, components that have indications that have been previously analytically evaluated in accordance with Section XI IWB-3600 until the end of the 40-year service period, shall be re-evaluated for the 60 year service period corresponding to the license renewal term.

The applicant performed the re-evaluation of the flaw and provided its analysis in LRA. The applicant stated that the flaw acceptance re-evaluation is based on the acceptance standards for flaws in reactor vessels in the ASME Code Section XI IWB-3500 and IWB-3600.

The applicant's re-evaluation concluded that for the Normal and Upset conditions, the maximum end of service life, applied stress intensity factor calculated for the indication is 16.1 ksi $(in)^{1/2}$. This applied stress intensity factor is well below the material fracture toughness of 63.2 ksi $(in)^{1/2}$. It stated that for emergency and faulted conditions and the maximum end of service life, applied stress intensity factor calculated in this analysis is 18.3 ksi $(in)^{1/2}$. This applied stress intensity factor is well below the material fracture toughness of 141.42 ksi $(in)^{1/2}$.

Based on these results, the applicant concluded that the existing flaw is acceptable and meets the requirements of the ASME Code, Section XI, IWB-3610. The re-evaluation shows acceptability for 54 EFPY (corresponding to 60 years) as discussed in BWRVIP-74-A.

The applicant stated that the analysis has been projected through the period of extended operation, and that the existing HCC-B002 indication TLAA has been demonstrated to be acceptable for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

4.7.3.2 Staff Evaluation

The staff reviewed LRA Section 4.7.3, to verify pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation.

The staff noted that the applicant has dispositioned its HCC-B002 indication in accordance with 10 CFR 54.21(c)(1)(ii). The staff noted that the 60-year service projection was based on the methodology specified in Appendix A of Section XI and the detailed fracture mechanics evaluations prescribed in the ASME Code Section XI IWB-3600. The applicant's re-evaluation showed acceptability for 54 EFPY (correspond to 60 years) that covers the period of extended operation. The staff noted that the applicant dispositioned its HCC-B002 TLAA in accordance with 10 CFR 54.21(c)(1)(ii) because its evaluation shows that the applied stress intensity factor is well below the material fracture toughness and that the re-evaluation provided conservative projections for 60 years of service.

4.7.3.3 UFSAR Supplement

The applicant provided the UFSAR supplement summarizing its TLAA evaluation of existing HCC-B002 "Dollar Weld" indication in LRA Section A.18.3.5.3. Based on its review of the UFSAR supplement, the staff concludes that the applicant provided an adequate summary description of its actions to address the HCC-B002 "Dollar Weld" indication.

4.7.3.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the existing HCC-B002 "Dollar Weld" indication remains acceptable in service during the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.4 Evaluation of Thermal Fatigue Effects on Steam Lead and Inlet to RPV

4.7.4.1 Summary of Technical Information in the Application

In LRA Section 4.7.4, the applicant stated that in May of 1993, the NRC issued Bulletin 93-03 which requested that licensees implement modifications to alleviate concerns for inaccuracy in reactor vessel water level measurement due to accumulation of noncondensible gases in the sensing lines. The applicant stated that in response to that bulletin, as discussed in NG-93-4082 (letter dated October 13, 1993, Iowa Electric Light and Power to NRC), the DAEC installed a reference leg backfill modification. The applicant also stated that the reactor water level instrumentation was modified by incorporating a flow path for a small quantity of water from the CRD system into the reactor water level instrumentation reference legs. The applicant stated that this small amount of water (approximately 6 pounds-mass per hour) was calculated to result in an exchange of water in the reference leg each eight hours.

The applicant stated that the modification included an evaluation of the effect of maximum backflow on the inlet to the condensate pot (CP) at start of backflow system with the chamber at 545 °F for backflows of 6 lb/hr and maximum of 36.1 lb/hr and determined that the maximum differential temperatures is bounded within 200 °F.

The applicant also stated that it performed an analysis to investigate fatigue effects due to backflush on condensing pot and steam lead piping and RPV nozzle with the following inputs: 25 cycles of maximum possible backflow; 200 cycles of the design backflow rate; backflush flow = 6 lb/hr and 36.1 lb/hr; injection temperatures = 100 °F and 130 °F.

The applicant stated that the evaluation was done for the piping connection to the CP (steam lead to CP joint), which was considered as the "worst case" site of potential thermal discontinuity stresses due to the injection of cold water from the backflush system into the CP steam lead. The applicant concluded that the maximum temperature differential obtained from four conditions considered above (6 and 36.1 lb/hr mass flow rate, each at 100 °F and 130 °F injection temperature) is bounded by 200 °F. The applicant stated that this temperature differential was used to show satisfaction of the requirements of the fatigue exemption contained in the stress report for the nuclear boiler instrumentation piping.

The applicant stated that the stress report fatigue exemption used 177 significant temperature cycles (for events such as plant startup and shutdown, etc.) for 40 years. To demonstrate acceptability of the reference leg backflush modification, the applicant stated that it added 200 cycles at 6 lb/hr backflush rate and 25 cycles at 36.1 lb/hr backflush rate. The applicant stated that this resulted in 402 significant cycles for 40 years for the CP joint location (177 + 200 + 25 = 402). Based on this, in accordance with ASME NB-3222.4(d), the applicant determined the limit of temperature differential to be 252 °F. The applicant concluded that since the differential temperature for the joint location, 200 °F, is less than 252 °F, this fatigue exemption condition in the stress report is satisfied for 40 years so the instrumentation piping is acceptable for 40 years under the conditions described above.

To determine validity for fatigue exemption for 60 years, the applicant first performed cycle projection for the startup and shutdown transient, as follows: 177 x 1.5 + 200 (at a backflush rate of 6 lb/hr) + 25 (at a backflush rate of 36.1 lb/hr). This results in 491 thermal cycles for 60 years. Based on this, in accordance with ASME NB-3222.4(d), the applicant determined the limit of temperature differential to be 267 °F. The applicant concluded that since the differential temperature for the joint location, 200 °F, is less than 267 °F, the instrumentation piping is shown to remain fatigue exempt for 60 years, pursuant to 10 CFR 54.21(c)(1)(ii).

4.7.4.2 Staff Evaluation

The staff reviewed LRA Section 4.7.4, pursuant to 10 CFR 54.21(c)(1)(ii), to verify that the TLAA is projected to the end of the period of extended operation.

The applicant determined the differential temperature limit in accordance with the method of NB-3222.4 as was performed in the original evaluation and this resulted in a differential temperature limit of 267 °F. The staff noted that the maximum differential temperatures were determined to be 189.2 °F and 194.9 °F, and the applicant conservatively used a bounding value of 200 °F in a fatigue analysis evaluation. The applicant stated that the previously determined 200 °F is less than 267 °F and, therefore, the instrumentation piping is shown to remain fatigue exempt for 60 years.

Based on its review, the staff found that the applicant's disposition of this analysis, in accordance with 10 CFR 54.21(c)(1)(ii), is acceptable because through rigorous analyses, the applicant has demonstrated that the differential temperature in the instrumentation piping is within the ASME Code allowable determined value of 267 °F under the reasonable operating range during the period of extended operation.

4.7.4.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of the thermal fatigue effects on steam lead and inlet to RPV in LRA Section A.18.3.5.4. On the basis of its review of the UFSAR supplement, the staff concluded that the summary description of the applicant's actions to address the thermal fatigue effects on steam lead and inlet to RPV is adequate.

4.7.4.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses of the thermal fatigue effects on steam lead and inlet to RPV is projected to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.5 Control Rod Drive Mechanism Fatigue

4.7.5.1 Summary of Technical Information in the Application

In LRA Section 4.7.5, the applicant stated that it has performed analysis for cyclic operation of the CRDMs and determined that the 40-year maximum CUF is 0.15 for the limiting CRDM main flange at EPU conditions. To estimate the 60-year CUF, the applicant multiplied the 40-year results by a factor of 1.5 (ratio of 60 and 40), and concluded that the fatigue requirement was satisfied through the end of the period of extended operation.

The applicant also stated that the stress analysis report for the control rod drive hydraulic system (CRDHS) provides analyses performed in accordance with applicable portions of ASME Section III, Edition 1971. The applicant stated that the CUFs for the insert/withdrawal lines, discharge piping, and scram monitoring stations remain below 1.0 when multiplied by 1.5, and are, therefore, acceptable for 60 years. For the scram headers, however, the applicant stated that multiplying by a factor of 1.5 would result in a CUF greater than 1.0. Therefore, the applicant indicated that it performed a review of the evaluation and found that the cyclic fatigue on the scram header is due primarily to scram and earthquake cycles. The applicant further stated that since the design number of scram cycles is being reduced from 200 to 150, and the earthquake assumptions remain unchanged, the 60-year CUF values remain below 1.0 and are, therefore, acceptable.

The applicant stated that the fatigue analysis exemption for the scram discharge volume (SDV) vent and drain valves remains bounding for a 60-year life.

Based on the results shown above, the applicant concluded that the analyses either remain valid or have been projected through the period of extended operation, and the aging issue will be managed in accordance with 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(ii).

4.7.5.2 Staff Evaluation

The staff reviewed LRA Section 4.7.5, pursuant to 10 CFR 54.21(c)(1)(i), to verify that the TLAA remains valid to the end of the period of extended operation for some components; and pursuant to 10 CFR 54.21(c)(1)(ii), to verify that the TLAA is projected to the end of the period of extended operation for the rest of the components within the domain of the CRDMs.

The staff noted that the analysis methodology used by the applicant for the CRDM fatigue analysis is not adequately described in its LRA. In LRA Section 4.7.5, the applicant stated that for the scram headers, acceptable 60 year CUF can not be obtained by raising the 40-year CUF by 1.5 and that, "since the design number of scram cycles is being reduced from 200 to 150, and the earthquake assumptions remain unchanged, the 60-year CUF values remain below 1.0 and are therefore acceptable." The staff noted that there is insufficient information provided in the LRA for this conclusion. By letter dated November 13, 2009, the staff issued RAI 4.7.5, requesting that the applicant:

(a) Provide the reference used as the basis for the fatigue analysis for CRDM at EPU conditions.

(b) Provide the basis that reducing the design cycles of scram from 200 to 150 will lead to an acceptable 60-year CUF for the scram headers.

(c) Provide the basis that fatigue analysis exemption for the SDV vent and drain valves will remain bounding for 60 years of plant life. Also, explain the acronym SDV, which is not included in the abbreviation table of the LRA.

(d) Separate the analyses for the CRDM which were placed in mixed categories of 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(ii). Separate the regulatory dispositions appropriately for different components.

In its response to RAI 4.7.5, Part (a), dated December 14, 2009, the applicant provided three references that supports the fatigue analyses for the CRDM at EPU conditions: (1) GE report NEDC-32980P, "Safety Analysis Report for Duane Arnold Energy Center Extended Power Uprate (EPU)." The staff noted that this report contains a discussion regarding the evaluation of the CUF value for the CRDM. The staff further noted that this report was submitted to the staff by letter NG-01-0523, dated May 8, 2001 (ML011350607); (2) NRC Amendment 243, NRC letter (ML013050321) which allowed an increase in the maximum power level from 1,658 MWt to 1,912 MW_{th}; (3) NRC SE for EPU (ML013050342).

Based on its review, the staff finds the applicant's response to RAI 4.7.5, Part (a), acceptable because the applicant provided the sources of information to support the required analysis for the CUF value of the CRDM and the staff approved the applicant to operate at EPU conditions. The staff's concern described in RAI 4.7.5, Part (a), is resolved.

In its response to RAI 4.7.5, Part (b), dated December 14, 2009, the applicant stated that it performed a review of its plant operation and estimated 150 scram cycles during 60 years of plant life. The applicant also stated that since 200 scram cycles were used in the original 40-year design analysis and now the cycles are reduced to 150, the existing evaluation for the scram headers remains valid for 60 years of operation. The applicant stated that the scram headers are only subject to scram cycles and earthquakes and the cycles for the earthquakes are assumed to stay the same.

Based on its review, the staff finds the applicant's response to RAI 4.7.5, Part (b), acceptable because the number of scram cycles for 60-year fatigue evaluation is less than the number of cycles used in the 40-year design analysis, thus, the original design analysis results (using 200 cycles) remain valid. The staff's concern described in RAI 4.7.5, Part (b), is resolved.

In its response to RAI 4.7.5, Part (c), dated December 14, 2009, the applicant stated that SDV is the acronym standing for scram discharge volume. The applicant also stated that it has performed a review of the SDV vent and drain valves analyses and confirmed that these piping components met the six requirements of Subparagraph NB-3222.4(d) for exemption of fatigue analyses. The applicant further stated that the estimated 60-year scram cycles have been reduced from 200 to 150 cycles, as described in Part (b).

Based on its review, the staff finds the applicant's response to RAI 4.7.5, Part (c), acceptable because: (1) the number of scram cycles for 60-year fatigue evaluation is less than the number of cycles used in the 40-year design analysis, thus, the original design analysis results for the SDV vent and drain valves (using 200 cycles) remain valid, (2) the applicant performed its fatigue analysis exemption evaluation based on the requirements of ASME Code Section III Subparagraph NB-3222.4(d), and (3) the applicant has concluded that these locations are exempt from fatigue analysis. The staff's concern described in RAI 4.7.5, Part (c), is resolved.

In its response to RAI 4.7.5, Part (d), dated December 14, 2009, the applicant stated that the regulatory disposition statement shown in LRA Section 4.7.5, "Control Rod Drive Mechanism Fatigue," is now revised to read as follows:

> Disposition: 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(ii) as indicated below:
>
> (i) The analyses remain valid for the period of extended operation for the fatigue-exempt SDV vent and drain valves and for the scram headers.
>
> (ii) The analyses have been projected to the end of the period of extended operation for the CRDM, insert/withdraw lines, discharge piping, and scram monitoring stations.

Based on its review, the staff finds the applicant's response to RAI 4.7.5, Part (d), acceptable because the applicant amended its LRA to clearly identify the disposition of 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(ii) for the specific portions of its CRDM fatigue analyses. The staff's concern described in RAI 4.7.5, Part (d), is resolved.

Based on its review, the staff finds the applicant's response to RAI 4.7.5 acceptable in its entirety as described above. The staff's concern described in RAI 4.7.5 is resolved.

4.7.5.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of the fatigue life of the CRDM in LRA Section A.18.3.5.5. On the basis of its review of the UFSAR supplement, the staff concluded that the summary description of the applicant's actions to address the fatigue life of the CRDM is adequate.

4.7.5.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated that the TLAAs for the SDV vent, drain valves, and the scram headers remain valid to the end of the period of extended operation, pursuant to 10 CFR 54.21(c)(1)(i), and the TLAAs for the CRDM, insert/withdraw lines, discharge piping, and scram monitoring stations are projected to the end of the period of extended operation, pursuant to 10 CFR 54.21(c)(1)(ii). The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.6 Main Steam Isolation Valve D Flaw Evaluation

4.7.6.1 Summary of Technical Information in the Application

LRA Section 4.7.6 discusses the MSIV “D” flaw evaluation. The applicant stated that during the 1993 RFO, the “D” outboard MSIV (CV4421) failed as-found local leakage rate testing. The applicant stated that to improve its leak-tightness, the valve was disassembled, inspected, and remanufactured to restore its bore to within design specifications. The applicant stated that subsequent repair efforts lead to exposure of additional indications and that after some re-machining (grinding, welding), three unacceptable indications remained which were not reduced to an acceptable length before welding, resulting in the repairs not meeting Code requirements. The staff, however, approved the non-ASME Code repair.

The applicant stated that it evaluated the remaining three flaws using the criteria described in ASME Code Articles IWA-3000 and IWB-3000 and the proximity rules of IWA-3320. These rules require the three flaws to be considered as a single flaw of 2 inches in length, which was then analyzed by assuming varying aspect ratios from 6:1 to 2:1. The applicant stated that as a result of the weld repair, the assumed flaw was considered to be subsurface (ASME IWA-3330(b) and IWA-3320). The applicant performed an analytical evaluation of the flaws per ASME Code Section XI, IWB-3600 and Appendix A that concluded that the flaws in the MSIV body were bounded by the assumed flaw sizes in this analysis and were within ASME Code Section XI, IWB-3612 requirements for normal and faulted conditions. The applicant concluded that on the basis of the fatigue crack growth analysis, the evaluation demonstrated the flaws to be acceptable for 40 years of operation per the requirements of the ASME Code Section XI, IWB-3600.

The applicant stated that the staff issued an SE in 1993 which accepted the subsurface indications grouping to a single 2-inch long flaw (IWA-3320). The applicant stated that the staff found the flaw evaluation as per ASME Code Section XI, IWB-3600 acceptable, demonstrating compliance with IWB-3612 requirements for up to a bounding flaw of 2 inches and noted that the assumptions on initial flaw size, fracture toughness, and loadings were conservative. The applicant stated that the fatigue crack growth analysis demonstrated that growth by fatigue will not significantly impact the structural integrity of the MSIV body over the remaining service lifetime. The applicant stated that the staff imposed requirements to perform two radiographic inspections in subsequent outages, which was subsequently reduced to a single radiographic inspection, whenever the MSIV was to be disassembled for other reasons.

The applicant stated that according to BWRVIP-74-A, “BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal,” components that have indications previously analytically evaluated in accordance with ASME Code Section XI, IWB-3600 for 40-year service, shall be reevaluated for a 60-year service period. The applicant stated that it has reevaluated this MSIV for a 60-year plant life and that the evaluation took into account: (1) the 1993 calculation of the assumed flaw of 2 inches in length and with variable aspect ratios (6:1 to 2:1) for crack growth under typical mechanical and thermal loadings for an anticipated 40-year life and (2) the magnetic particle inspections performed during the weld process and post-weld radiography. The applicant stated that these inspections verified that flaws do not exist in the weld inlay and that the casting around the repaired area met the original construction code. The applicant further stated that the radiography performed during the 1993 RFO provided a best estimate through the wall flaw of 0.04 inches which was significantly less than the assumed flaw having 2:1 to 6:1 aspect ratios. The applicant concluded that the flaw is acceptable for 40 years of operation from the time of the radiography (1993), until 2033. The applicant stated that the bounding flaw sizes evaluated, margin to acceptance criteria, and NRC SE requirement to perform a radiographic inspection of the repair when disassembled provide adequate basis for acceptance, also for the remaining year or until the end of the 60-year term (2034).

The applicant stated that it had concluded that the analysis remains valid for the period of extended operation, pursuant to 10 CFR 54.21(c)(1)(i).

4.7.6.2 Staff Evaluation

The staff reviewed LRA Section 4.7.6, pursuant to 10 CFR 54.21(c)(1)(i), to verify that the TLAA remains valid to the end of the period of extended operation. In addition, the staff also revisited the applicant's past analysis (see ADAMS legacy No. 9309300149) and the staff's SE (ADAMS legacy No. 9309300130). The staff points out page 11 of CAL-M93-023, which was provided as an attachment to the applicant's analysis, indicating conservatisms in loads and calculated crack growth values to the year 2033. For the remaining year (to 2034), the staff reasoned that adding a 1/40th of the crack extension experienced over a 40-year period for the flaw having a 2:1 aspect ratio would have an insignificant effect on the analysis. The staff, therefore, agrees with the applicant that the bounding flaw sizes evaluated, margin to acceptance criteria, and the staff's previous requirement to perform a radiographic inspection of the repair when the valve is disassembled provide adequate basis for the remaining year (2034) which is the end of the period of extended operation.

Based on the above, the staff concludes that there is sufficient basis for acceptance of the analysis until the end of the period of extended operation.

Based on its review, the staff finds that the applicant's disposition of this TLAA to 10 CFR 54.21(c)(1)(i) is acceptable.

4.7.6.3 UFSAR Supplement

LRA Section A.18.3.5.6 provides the UFSAR supplement summary description of the applicant's TLAA evaluation of the MSIV "D" flaw. On the basis of its review of the UFSAR supplement, the staff concluded that the summary description of the applicant's actions to address the operation of the MSIV is adequate.

4.7.6.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses of the MSIV "D" flaw will remain valid to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.7.7 Bellows Design Analysis

4.7.7.1 Summary of Technical Information in the Application

In LRA Section 4.7.7, the applicant stated that the bellows design analysis document provides design analysis information for primary containment penetrations models X-15 (reactor water cleanup supply) and X-9A/B (RPV feedwater). The applicant stated that the material is ASTM A240 T-304 SS. The applicant also stated that the fatigue life was the number of cycles taken from the point indicated on the S-N curve (with corrections for particular materials) corresponding to the bending stress calculated based on the deflection of the bellow. The applicant provided a reference for the technical basis used for the fatigue life determination, which is "Low Cycle Fatigue of Austenitic Stainless Steel" ASME Paper No. 61-WA-18 by B.F. Langer.

The applicant stated in the LRA that both X-15 and X-9A/B bellows are subjected to cycles sufficiently lower than the rated life cycles, under various operating conditions. The applicant summarized the cycles experienced under each of the operating conditions and concluded that the "Accident plus seismic" case for the X-15 model is dominating for both X-15 and X-9A/B bellows and stated that the number of 40-year design cycles is 200 with the rated cycle life being 1,220 cycles. The applicant further stated that by multiplying the design cycles by 1.5 (60 years/40 years), the 60-year cycle conservatively estimated as 300, which is still well below the rated cycle life of 1,220 cycles for that case.

Therefore, the applicant concluded that, the analysis remains valid for the period of extended operation, pursuant to 10 CFR 54.21(c)(1)(i).

4.7.7.2 Staff Evaluation

The staff reviewed LRA Section 4.7.7, pursuant to 10 CFR 54.21(c)(1)(i), to verify that the TLAA remains valid to the end of the period of extended operation.

The staff noted that for the primary containment penetrations X-15 and X-9A/B that even after multiplying the design cycles by 1.5 (60 years/40 years) with the 60-year cycle for the "operating," "accident," "operating plus seismic," and "accident plus seismic," this was still well below the rated cycle life. The staff further noted that the accident plus seismic for the X-15 penetration is the most limiting for both X-15 and X-9A/B penetrations, and the 60-year cycle of 300 is significantly below the rated cycle life of 1,220 cycles.

Based on its review, the staff found that the applicant's disposition of this TLAA to 10 CFR 54.21(c)(1)(i) acceptable because the 60-year cycles is well below the rated cycle life of the bellow even under the worst loading conditions.

4.7.7.3 UFSAR Supplement

The applicant provided a UFSAR supplement summary description of its TLAA evaluation of the fatigue life of the bellows LRA Section A.18.3.5.7. On the basis of its review of the UFSAR supplement, the staff concluded that the summary description of the applicant's actions to address the fatigue life of the bellows is adequate.

4.7.7.4 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated, pursuant to 10 CFR 54.21(c)(1)(i), that the analyses of the fatigue life of the bellows remains valid to the end of the period of extended operation. The staff also concludes that the UFSAR supplement contains an appropriate summary description of the TLAA evaluation, as required by 10 CFR 54.21(d).

4.8 Conclusion for Time-Limited Aging Analyses

The staff reviewed the information in LRA Section 4, "Time-Limited Aging Analyses." On the basis of its review, the staff concludes that the applicant has provided a sufficient list of TLAAs, as defined in 10 CFR 54.3 and that the applicant has demonstrated that: (1) the TLAAs will remain valid for the period of extended operation, as required by 10 CFR 54.21(c)(1)(i), (2) the TLAAs have been projected to the end of the period of extended operation, as required by 10 CFR 54.21(c)(1)(ii), or (3) that the effects of aging on intended functions will be adequately managed for the period of extended operation, as required by 10 CFR 54.21(c)(1)(iii). The staff also reviewed the UFSAR supplement for the TLAAs and finds that the supplement contains descriptions of the TLAAs sufficient to satisfy the requirements of 10 CFR 54.21(d). In addition, the staff concludes, as required by 10 CFR 54.21(c)(2), that no plant-specific, TLAA-based exemptions are in effect.

With regard to these matters, the staff concludes that there is reasonable assurance that the activities authorized by the renewed licenses will continue to be conducted in accordance with the CLB, and that any changes made to the CLB, in order to comply with 10 CFR 54.29(a), are in accordance with the Atomic Energy Act of 1954, as amended, and NRC regulations.

SECTION 5

REVIEW BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

In accordance with Title 10, Part 54, of the *Code of Federal Regulations*, the Advisory Committee on Reactor Safeguards (ACRS) will review the license renewal application (LRA) for Duane Arnold Energy Center. The ACRS Subcommittee on Plant License Renewal will continue its detailed review of the LRA after this safety evaluation report (SER) is issued. Florida Power and Light Energy Duane Arnold, LLC (FPL-DA or the applicant) and the staff of the United States (US) Nuclear Regulatory Commission (NRC) (the staff) will meet with the subcommittee and the full committee to discuss issues associated with the review of the LRA.

After the ACRS completes its review of the LRA and SER, the full committee will issue a report discussing the results of the review. An update to this SER will include the ACRS report and the staff's response to any issues and concerns reported.

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SECTION 6

CONCLUSION

The staff of the United States (US) Nuclear Regulatory Commission (NRC) (the staff) reviewed the license renewal application (LRA) for Duane Arnold Energy Center, 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 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 42, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Regarding Duane Arnold Energy Center, Draft Report for Comment," in February 2010. The staff further notes that the Final Supplement 42 was issued on October 15, 2010.

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Appendix A

DAEC LICENSE RENEWAL COMMITMENTS

During the review of the Duane Arnold Energy Center (DAEC), license renewal application (LRA) by the staff of the United States (US) Nuclear Regulatory Commission (NRC) (the staff), FPL Energy Duane Arnold, LLC (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.

Item Number	Commitment	FSAR Supplement Section/ LRA Section	Enhancement or Implementation Schedule
1. (Buried Piping and Tanks Inpsection Program)	Implement Buried Piping and Tank Program [Revised in DAEC letter NG-09-0764 in response to New Program Commitments RAI]	18.1.7	Prior to the period of extended operation
2. (BWR Vessel Internals Program)	Perform an EVT-1 inspection of 5% of the top guide locations	18.1.14	Within 6 years of entering the period of extended operation
3. (BWR Vessel Internals Program)	Perform an EVT-1 inspection of an additional 5% of the top guide locations	18.1.14	Within 12 years of entering the period of extended operation
4. (Electrical Cables and Connections Program)	Implement an Electrical Cables and Connections Program and complete the first inspection prior to the period of extended operation. [Revised in letter NG-09-0764 in response to New Program Commitments RAI]	18.1.17	Prior to the period of extended operation
5. (Electrical Cables and Connections Used in Instrumentation Circuits Program)	Implement an Electrical Cables and Connections Used in Instrumentation Circuits Program and complete the first inspection prior to the period of extended operation. [Revised in DAEC letter NG-09-0764 in response to New Program Commitments RAI]	18.1.18	Prior to the period of extended operation
6. (Electrical Connections Program)	Implement an Electrical Connections Program and complete the one-time inspection prior to the period of extended operation. [Revised in DAEC letter NG-09-0764 in response to New Program Commitments RAI]	18.1.19	Prior to the period of extended operation
7. (Electrical Cables and Connections Program)	Implement an Electrical Penetration Assemblies Program. [Revised in DAEC letter NG-09-0764 in response to New Program Commitments RAI]	18.1.20	Prior to the period of extended operation

Item Number	Commitment	FSAR Supplement Section/ LRA Section	Enhancement or Implementation Schedule
8. (External Surface Monitoring Program)	Revise the inspection program to address inspector qualifications, types of components, degradation mechanisms, aging effects, acceptance criteria, inspection frequency, and periodic reviews to determine program effectiveness. The program will also specifically address inaccessible areas and include inspections of opportunity for possible corrosion under insulation. [Revised in DAEC letter NG-09-0764 in response to RAI B.3.21-2]	18.1.21	Prior to the period of extended operation
9. (Fire Protection Program)	The DAEC Fire Barrier Penetration Seal Inspection surveillance procedure will be enhanced to include criteria for visual inspections of fire barrier wall, ceiling and floors to examine for any sign of degradation such as cracking, spalling and loss of material caused by freeze-thaw, chemical attack and reaction with aggregates by the fire protection qualified inspectors. [Revised in DAEC letter NG-09-0764 in response to RAI B.3.22.-1].	18.1.22	Prior to the period of extended operation
10. (Fire Protection Program)	Enhance procedures to inspect the entire diesel driven fire pump supply line for age related degradation.	18.1.22	Prior to the period of extended operation
11. (Fire Water System Program)	Implement maintenance activities to perform volumetric examinations for pipe wall thinning of fire protection piping periodically during the period of extended operation. [Revised in DAEC letter NG-09-0764 in response to New Program Commitments RAI]	18.1.23	Prior to the period of extended operation
12. (Fire Water System Program)	Enhance procedures to include NFPA 25 criteria for sprinklers regarding replacing or testing.	18.1.23	Prior to the period of extended operation
13. (Fire Water System Program)	Enhance procedures to perform visual inspection of fire hydrants annually.	18.1.23	Prior to the period of extended operation

Item Number	Commitment	FSAR Supplement Section/ LRA Section	Enhancement or Implementation Schedule
14. (Fuel Oil Chemisty Program)	Revise the program to require particulate testing of fuel oil samples from the diesel fire pump day tank	18.1.25	Prior to the period of extended operation
15. (Fuel Oil Chemisty Program)	Enhance procedures to require sampling and testing of new fuel oil delivered to the diesel fire pump day tank; and to require that purchase orders and sampling procedures for diesel fuel delivered to and stored in the diesel fire pump day tank prohibit the delivery and use of biodiesel fuel. [Revised in DAEC letter NG-09-0764 in response to RAI B.3.25-1]	18.1.25	Prior to the period of extended operation
16. (Fuel Oil Chemisty Program)	Enhance procedures to perform periodic (10 year) draining, cleaning and visual inspection of the diesel fuel oil day tanks, diesel fire pump day tank, and diesel driven air start air compressor fuel oil tanks. [Revised in DAEC letter NG-09-0764 in response to RAI B.3.25-4]	18.1.25	Prior to the period of extended operation
17. (Fuel Oil Chemisty Program)	Implement procedures to require bottom thickness testing of the Standby Diesel Generator Day Tanks and the Diesel Fire Pump Day Tank. [Revised in DAEC letter NG-09-0764 in response to New Program Commitments RAI]	18.1.25	Prior to the period of extended operation
18. (Fuse Holders Program)	Implement a Fuse Holders Program and complete the first test prior to the period of extended operation. [Revised in DAEC letter NG-09-0764 in response to RAI B.3.26-1 and New Program Commitments RAI]	18.1.26	Prior to the period of extended operation

Item Number	Commitment	FSAR Supplement Section/ LRA Section	Enhancement or Implementation Schedule
19. (Inaccessible Medium Voltage Cable Program)	Implement an Inaccessible Medium Voltage Cable Program and complete the first inspection or test prior to the period of extended operation. [Revised in DAEC letter NG-09-0764 in response to New Program Commitments RAI]	18.1.27	Prior to the period of extended operation
20. (Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program)	Implement an Inspect of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. [Revised in DAEC letter NG-09-0764 in response to New Program Commitments RAI]	18.1.28	Prior to the period of extended operation
21. (Inspection of Overhead HeavyLoad and Light Load (Related to Refueling) Handling Systems Program)	Enhance procedures to monitor for corrosion and wear of the supporting steel and rails	18.1.29	Prior to the period of extended operation
22. (Inspection of Overhead HeavyLoad and Light Load (Related to Refueling) Handling Systems Program)	Enhance procedures to record usage of the reactor building and turbine building cranes	18.1.29	Prior to the period of extended operation
23. (Lubricating Oil Analysis Program)	Enhance procedures to include diesel fire pump	18.1.30	Prior to the period of extended operation

Item Number	Commitment	FSAR Supplement Section/ LRA Section	Enhancement or Implementation Schedule
24. (Metal Enclosed Bus Program)	Implement a Metal Enclosed Bus Program and complete the first inspection prior to the period of extended operation. [Revised in DAEC letter NG-09-0764 in response to New Program Commitments RAI]	18.1.31	Prior to the period of extended operation
25. (One-Time Inspection Program)	Implement a One-Time Inspection Program and complete the one-time inspections prior to the period of extended operation. [Revised in DAEC letter NG-09-0764 in response to New Program Commitments RAI]	18.1.32	Prior to the period of extended operation
26. (Reactor Vessel Surveillance Program)	Implement a procedure to evaluate the BWRVIP ISP data as it becomes available. [Revised in DAEC letter NG-09-0764 in response to New Program Commitments RAI]	18.1.35	Prior to the period of extended operation
27. (Reactor Vessel Surveillance Program) BWRVIP-74-A BWR PRV Inspection and Flaw Evaluation Guidelines for License Renewal)	Revise the Reactor Vessel Surveillance Program to implement the recommendations of BWRVIP-116 BWR Vessel and Internals Project Integrated Surveillance Program Implementation for License Renewal.	18.1.35	Prior to the period of extended operation

Item Number	Commitment	FSAR Supplement Section/ LRA Section	Enhancement or Implementation Schedule
28. (Reactor Vessel Surveillance Program)	Implement BWRVIP-116 with the conditions documented in Sections 3 and 4 of the NRC Staff's SE dated March 1, 2006 for BWRVIP-116, including the following: • . NRC approval will be obtained for any change in the withdrawal schedules of the DAEC Reactor Vessel surveillance capsules. • If a standby capsule is removed from the DAEC 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, if necessary [Revised in DAEC letter NG-09-0764 in response to RAI B.3.35-1]	18.1.35	Prior to the period of extended operation
29. (Selective Leaching of Materials Program)	Implement and complete a program to include one-time visual inspection and hardness measurement of selected components susceptible to selective leaching. [Revised in DAEC letter NG-09-0764 in response to New Program Commitments RAI]	18.1.36	Prior to the period of extended operation
30. (Structures Monitoring Program)	Enhance procedures to include structures and structural components not currently in Maintenance Rule Program.	18.1.37	Prior to the period of extended operation
31. (Structures Monitoring Program)	Enhance procedures to include periodic sampling of groundwater for pH, chloride and sulfate concentration on a 5 year periodicity. [Revised in DAEC letter NG-09-0764 in response to RAI B.3.37-2]	18.1.37	Prior to the period of extended operation
32. (Structures Monitoring Program)	Enhance procedures to include an elastomer inspection to prevent leakage through containment penetration.	18.1.37	Prior to the period of extended operation

Item Number	Commitment	FSAR Supplement Section/ LRA Section	Enhancement or Implementation Schedule
33. (Structures Monitoring Program)	Enhance procedures to include a requirement to contact the proper personnel to allow opportunistic inspection of the buried concrete foundation.	18.1.37	Prior to the period of extended operation
34. (Structures Monitoring Program)	Enhance procedures to include opportunistic inspections of the buried concrete foundation on a 10 year periodicity.	18.1.37	Prior to the period of extended operation
35. (Metal Fatigue of Reactor Vessel Coolant Pressure Boundary Program)	Enhance procedures to incorporate the requirements of NUREG/CR 6260 locations into the implementing procedures.	18.2.2	Prior to the period of extended operation
36. (Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program)	Implement a Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program. [Revised in DAEC letter NG-09-0764 in response to New Program Commitment RAI]	18.1.38	Prior to the period of extended operation
37. (BWR Vessel Internals Program)	DAEC will ensure that aging of core plate hold down bolts is appropriately addressed by completing one of the following actions: • Install core plate wedges to eliminate the function of core plate hold bolts. • Perform analysis of the core plate rim hold down bolts that demonstrates adequacy to perform their intended function including loss of pre-load in the period of extended operation including the effects of projected neutron fluence. Inspection of core plate hold down bolts will be performed in accordance with BWRVIP-25 or a deviation disposition will be developed/submitted in accordance with BWRVIP-94. [Revised in DAEC letter NG-10-0091]	18.1.14 18.3.1.7	Prior to the period of extended operation

Item Number	Commitment	FSAR Supplement Section/ LRA Section	Enhancement or Implementation Schedule
38. (Reactor Vessel Circumferential Weld TLAA)	Submit a relief request to address the frequency requirements of the inservice inspection of the RPV circumferential welds. (BWRVIP-05).	18.3.1.4	Prior to the period of extended operation
39. (Quality Assurance Program (Corrective Action, Confirmation Process, Administrative Controls)	Expand the scope of its 10 CFR Part 50, Appendix B Quality Assurance program to include non-safety-related structures and components subject to an AMR for license renewal.	UFSAR 17.1.2	Prior to the period of extended operation
40. (Operating Experience)	Perform an operating experience review of extended power uprate and its impact on aging management programs for systems, structures, and components (SSCs) before entering the period of extended operation.		Prior to the period of extended operation
41. (Bolting Integrity)	Revise the implementing procedures for the ASME Section XI Inservice Inspection Subsections IWB, IWC, and IWD Program; ASME Section X1 Inservice Inspection, Subsection IWF Program; External Surfaces Monitoring Program; Structural Monitoring Program; and Buried Piping and Tanks Program such that they specifically address the inspection of fasteners (bolting, washers, nuts, etc.) for signs of leakage, corrosion/loss of material, cracking, and loss of preload/loss of prestress, as applicable. [Added in letter NG-09-0764 in response to RAI B.3.6-02]	18.1.6	Prior to the period of extended operation
42. (BWR Penetrations Program)	The implementing document for the BWR Penetrations Program Program will be revised to specify that guidance in BWRVIP-14, -59 and - 60 will be used, as appropriate, depending on material, in the evaluation of crack growth in stainless steel, nickel alloys and low-alloy steels, respectively, when flaws are identified and evaluation required. [Added in letter NG-09-0764 in response to RAI B.3.10-5] [Revised in letter NG-1 0-0009]	18.1.10	Prior to the period of extended operation

Item Number	Commitment	FSAR Supplement Section/ LRA Section	Enhancement or Implementation Schedule
43. (Fire Protection Program)	The DAEC Fire Barrier Penetration Seal Inspection surveillance procedure will be enhanced to ensure a approximately 10% of each type of penetration seal is included in the 35 percent selection of fire penetration seals that are visually inspected at an 18 month interval. [Added in letter NG-09-0764 in response to RAI B.3.22-1]	18.1.22	Prior to the period of extended operation
44. (Fire Protection Program)	The DAEC Surveillance Procedure for the C02 Cardox System Operability Annual Test will be enhanced to include a step to perform an inspection for corrosion and mechanical damage to system components. [Added in letter NG-09-0764 in response to RAI B.3.22-1]	18.1.22	Prior to the period of extended operation
45. (ASME Class 1 Small-bore Piping Inspection Program)	Implement an ASME Code Class 1 Small-bore Piping Inspection Program. DAEC will perform volumetric examination of a minimum of ten percent of the ASME Code Class 1 small-bore socket welds each inspection interval. The ASME Code Class 1 Small-bore Piping inspection program will include provisions that a destructive examination may be performed on an opportunities basis in lieu of the socket weld volumetric examinations. [Added in letter NG-09-0764 in response to RAI B.3.3-2] [Revised in letter NG-10-0258] [Revised in letter NG-10-0309]	18.1.40	Prior to the period of extended operation
46. (BWR Vessel Internals Program)	The BWR Vessel Internals Program will incorporate the crack growth rate evaluations specified in the BWRVIP-100-A report. Plant-specific inspection intervals will be developed for DAEC core shroud welds that are exposed to a neutron fluence value equal to or greater than 1 X 10^{21} n/cm^2 (E > 1 MeV), as needed. [Added in letter NG-09-0663 in response to RAI B.3.14-5]	18.1.14	Prior to the period of extended operation
47.	Not Used [Withdrawn in letter NG-10-0091]		

Item Number	Commitment	FSAR Supplement Section/ LRA Section	Enhancement or Implementation Schedule
48. (Boral Surveillance Program)	Implement a Boral Surveillance Program and complete the first in-situ neutron attenuation test of the PaR spent fuel racks. [Added in letter NG-10-0009]	18.1.41	Prior to the period of extended operation
49. (Fire Protection Program)	Enhance procedures to inspect the 1 hour fire rated gypsum board wall that separates the control room computer room area from the front panel area for aging due to cracking. [Added in letter NG-10-0043]	18.1.22	Prior to the period of extended operation
50. (ASME XI, Inservice Inspection, Subsection IWE Program)	Perform recoating of suppression pool interior surfaces below the water line. [Added in letter NG-10-0091]	18.1.4	Complete recoating prior to startup from the first refuel outage during the period of extended operation
51. (Metal Fatigue of Reactor Vessel Coolant Pressure Boundary Program)	Future revisions/updates to the environmental fatigue calculations for the Recirculation Inlet Nozzle Safe End, Feedwater Nozzle Safe End, and Core Spray Nozzle Safe End will use F_{en} data for Nickel Alloy from the methodology that is described in NUREG/CR-6909 in the determination of usage factors. [Added in letter NG-10-0258]	18.2.2	Upon calculation revision.

Item Number	Commitment	FSAR Supplement Section/ LRA Section	Enhancement or Implementation Schedule
52. Buried Piping and Tanks Inspection Program	Enhance the Buried Piping and Tanks Inspection Program to include inspection of at least a minimum number of pipe segments in each material group (one stainless steel, two carbon steel, one cast iron, and two ductile iron) prior to entry into the period of extended operation and each ten-year period after entry into the period of extended operation. Where torsional guided wave data indicates significant susceptibility, inspections will be performed on associated locations. The sample locations for directed inspections will preferentially select higher risk locations. Piping that normally contains hazardous materials will be prioritized in the inspection location selection process. The diesel fuel oil piping will be inspected prior to entry into the period of extended operation. These directed inspections will be performed with sufficient excavation to expose at least ten linear feet of piping as practicable, including the pipe bottom. Inspections of coated carbon steel piping will include the coating and backfill in the vicinity of the piping for material that could cause coating damage. The uncoated stainless steel, ductile iron and cast iron piping will be externally inspected for corrosion, and the fill in the vicinity of the piping will be inspected for material that could cause external damage to the stainless steel, ductile iron or cast iron pipe. [Added in letter NG-10-0383] [Revised in letter NG-10-0427]	18.1.7	Prior to the period of extended operation

Item Number	Commitment	FSAR Supplement Section/ LRA Section	Enhancement or Implementation Schedule
53. Buried Piping and Tanks Inspection Program	Cathodic protection system availability will be maintained ≥ 90%. If 90% availability is not maintained, the condition will be entered into the corrective action program to evaluate the impact and take corrective actions. Availability will be demonstrated by having no more than six months of rectifier out-of-service time in any sixty-month period, as determined on a “per rectifier” basis; or no more than six months of rectifier out of-service time in any twelve-month period, for all rectifiers combined. Annual surveys will continue to be performed in accordance with NACE Standard Practice. [Added in letter NG-10-0383] [Revised in letter NG-10-0427]	18.1.7	Prior to the period of extended operation
54. Inaccessible Medium Voltage Cable Program	The program will be enhanced to include 480 V to 2 kV power cables. This includes enhancing the scope of the program, preventive actions, parameters monitored or inspected, detection of aging effects and operating experience. [Added in letter NG-10-0429]	18.1.27	Prior to the period of extended operation

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Appendix B

CHRONOLOGY

This appendix lists chronologically the routine licensing correspondence between the staff of the United States (US) Nuclear Regulatory Commission (NRC) (the staff) and FPL Energy Duane Arnold, LLC(PPL). This appendix also lists other correspondence on the staff's review of the Duane Arnold Energy Center (DAEC) license renewal application (LRA) (under Docket No. 50-331).

APPENDIX B: CHRONOLOGY	
Date	**Subject**
09/30/2008	Letter, from Anderson R L, FPL Energy Duane Arnold, LLC, NRC/Document Control DeskNRC/NRR, "Duane Arnold Energy Center Application for Renewed Operating License TSCR-109." (ML082980480)
09/30/2008	Letter, from Holian B E, NRC/NRR/DLR, to Anderson R L, FPL Energy Duane Arnold, LLC, "Rreview Status of the License Renewal Application Duane Arnold Energy Center License Renewal Application." (ML083290275)
09/30/2008	License-Application for Facility Operating License (Amend/Renewal) DKT 50, FPL Energy Duane Arnold, LLC, NRC/NRR, "Duane Arnold Energy Center License Renewal Application, September 2008." (ML082980481)
12/18/2008	Letter, from Anderson R L, FPL Energy Duane Arnold, LLC, NRC/Document Control Desk NRC/NRR, "Responses to Issues Raised in the Rreview Status of the License Renewal Application." (ML083570149)
01/23/2009	Letter, from Anderson R L, FPL Energy Duane Arnold, LLC, NRC/Document Control Desk NRC/NRR, "Duane Arnold - License Renewal Application, Supplement 1: Changes Resulting from Issues Raised in the Review Status of the License Renewal Application for the Duane Arnold Energy Center." (ML090280418)
04/08/2009	Meeting Agenda Meeting Notice Memoranda, from Heath M L, NRC/NRR/DLR/RPB1, to Pelton D L, NRC/NRR/DLR/RPB1, "04/22/09 Forthcoming Meeting to Discuss the Safety Review Process and Environmental Scoping Process for Duane Arnold Energy Center." (ML090850537)
04/22/2009	Meeting Transcript, NRC/NRR/DLR/RPB1, "Transcript of Duane Arnold Energy Center Public Meeting: Evening Session, Wednesday, April 22, 2009, Pages 1-26." (ML091870229)
05/27/2009	Memoranda Safety Evaluation, from Cranston G V, NRC/NRR/DSS/SRXB, to Mitchell M A, NRC/NRR/DCI/CVIB, "Duane Arnold Energy Center - Request for Renewed Operating License - Reactor Systems Branch Evaluation of Pressure Vessel Neutron Fluence Calculation (TAC NO MD9769)." (ML091470534)
05/28/2009	Letter Schedule and Calendars, from Heath M L, NRC/NRR/DLR/RPB1, to Anderson R L, FPL Energy Duane Arnold, LLC, "Schedule to Conduct the Review of the Duane Arnold License Renewal Application (TAC No. MD9769)." (ML091200187)
06/05/2009	Letter, from Pelton D L, NRC/NRR/DLR/RPB1, to Anderson R L, FPL Energy Duane Arnold, LLC, "Duane Arnold Energy Center License Renewal Application Regulatory Audit Plan." (ML091470056)
07/17/2009	Meeting Transcript, NRC/NRR/DLR/RPB1, "Transcript of Duane Arnold Energy Center Public Meeting: Afternoon Session, Wednesday, April 22, 2009, Pages 1-35." (ML091870099)

APPENDIX B: CHRONOLOGY	
Date	**Subject**
07/20/2009	Letter, from Pelton D L, NRC/NRR/DLR/RPB1, to Anderson R L, FPL Energy Duane Arnold, LLC, "Audit Plan for Aging Management Program Site Audit Regarding Duane Arnold Energy Center License Renewal Application." (ML091940092)
08/07/2009	Letter Request for Additional Information (RAI), from Heath M L, NRC/NRR/DLR/RPB1, to Anderson R L, FPL Energy Duane Arnold, LLC, "Request for Additional Information for the Review of the Duane Arnold Energy Center License Renewal Application - Section 2.5." (ML091980178)
08/07/2009	Letter Request for Additional Information (RAI), from Heath M L, NRC/NRR/DLR/RPB1, to Anderson R L, FPL Energy Duane Arnold, LLC, "Request for Additional Information for the Review of the Duane Arnold Energy Center License Renewal Application - Section 2.2 and 2.3." (ML092080414)
08/07/2009	Letter Request for Additional Information (RAI), from Heath M L, NRC/NRR/DLR/RPB1, to Anderson R L, FPL Energy Duane Arnold, LLC, "Request for Additional Information for the Review of the Duane Arnold Energy Center License Renewal Application - Section 2.3 (TAC No. MD9769)." (ML092120539)
08/07/2009	Letter Request for Additional Information (RAI), from Heath M L, NRC/NRR/DLR/RPB1, to Anderson R L, FPL Energy Duane Arnold, LLC, "Request for Additional Information for the Review of the Duane Arnold Energy Center License Renewal Application-Section 2.3.3.1.1 (Tac MD9769)." (ML092150209)
08/14/2009	Letter, from Heath M, NRC/NRR/DLR/RPB1, to Anderson R L, FPL Energy Duane Arnold, LLC, "Request for Additional Information for the Review of the Duane Arnold Energy Center License Renewal Application - TLAA 4.2, B.3.12, B.3.13, B.3.14, B.3.35." (ML091970172)
08/18/2009	Letter, from Pelton D L, NRC/NRR/DLR/RPB1, to Anderson R L, FPL Energy Duane Arnold, LLC, "Project Manager Change for the License Renewal Project (Safety) for Duane Arnold Nuclear Power Station." (ML092170356)
09/03/2009	Letter, from Costanzo C R, NextEra Energy Duane Arnold, LLC, NRC/Document Control Desk NRC/NRR, "Duane Arnold Energy Center, Response to Request for Additional Information Regarding Section 2.5 of the License Renewal Application." (ML092510452)
09/03/2009	Letter, from Costanzo C R, NextEra Energy Duane Arnold, LLC, NRC/Document Control Desk NRC/NRR, "Duane Arnold Energy Center, Response to Request for Additional Information Regarding Section 2.3 of the License Renewal Application." (ML092510453)
09/03/2009	Letter, from Costanzo C R, NextEra Energy Duane Arnold, LLC, NRC/Document Control Desk NRC/NRR, "Response to Request for Additional Information Regarding Sections 2.2 and 2.3 of the Duane Arnold Energy Center License Renewal Application." (ML092510454)
09/03/2009	Letter, from Costanzo C R, NextEra Energy Duane Arnold, LLC, NRC/Document Control Desk NRC/NRR, "Response to Request for Additional Information Regarding Section 2.3.3.11 of the Duane Arnold Energy Center License Renewal Application." (ML092510455)
09/14/2009	Letter Request for Additional Information (RAI), from Harris B K, NRC/NRR/DLR/RPB1, to Costanzo C, Florida Power & Light Co FPL Energy Duane Arnold, LLC, "Duane Arnold, RAI for the Review of the Duane Arnold Energy Center License Renewal Application." (ML092310358)

APPENDIX B: CHRONOLOGY	
Date	**Subject**
10/02/2009	Letter, from Costanzo C R, NextEra Energy Duane Arnold, LLC, NRC/Document Control Desk, "First Annual Amendment to the Duane Arnold Energy Center License Renewal Application," (ML092750089)
10/16/2009	Letter Request for Additional Information (RAI), from Harris B K, NRC/NRR/DLR/RPB1, to Costanzo C, NextEra Energy Duane Arnold, LLC, "Request for Additional Information for the Review of the Duane Arnold Energy Center License Renewal Application - Batch 2," (ML092870537)
10/23/2009	Letter, from Costanzo C R, NextEra Energy Duane Arnold, LLC, NRC/Document Control Desk NRC/NRR, "Duane Arnold Energy, Response to Request for Additional Information Regarding Time-Limited Aging Analyses and Aging Management Programs License Renewal Application." (ML093000502)
10/23/2009	Letter, from Costanzo C R, NextEra Energy Duane Arnold, LLC, NRC/Document Control Desk NRC/NRR, "Response to Request for Additional Information Regarding Boral and Protective Coatings in the Duane Arnold Energy Center License Renewal Application." (ML093000504)
11/02/2009	Letter Request for Additional Information (RAI), from Harris B K, NRC/NRR/DLR/RPB1, to Costanzo C, NextEra Energy Duane Arnold, LLC, "Request for Additional Information for the Review of the Duane Arnold Energy Center License Renewal Application - Scoping and Screening Review," (ML092870453)
11/02/2009	Audit Report Letter Trip Report, from Harris B K, NRC/NRR/DLR/RPB1, to Costanzo C, NextEra Energy Duane Arnold, LLC, "Scoping and Screening Audit Report Regarding the Review of the Duane Arnold Energy Center License Renewal Application." (ML092940435)
12/14/2009	Letter, from Costanzo C R, NextEra Energy Duane Arnold, LLC, NRC/Document Control Desk NRC/NRR, "Duane Arnold Energy Center - Response to Request for Additional Information Regarding the License Renewal Application - Aging Management Review Line Items." (ML093500263)
12/29/2009	Letter Schedule and Calendars, from Harris B K, NRC/NRR/DLR/RPB1, to Costanzo C, Florida Power & Light Co, "Revision of Schedule for the Conduct of Review of the Duane Arnold Energy Center License Renewal Application (TAC No. MD9769)." (ML093451650)
01/06/2010	Letter Request for Additional Information (RAI), from Harris B K, NRC/NRR/DLR/RPB1, to Costanzo C, NextEra Energy Duane Arnold, LLC, "Request for Additional Information for the Review of the Duane Arnold Energy Center License Renewal Application - Batch 3." (ML093630034)
01/07/2010	Meeting Summary Memoranda, from Harris B K, NRC/NRR/DLR/RPB1, NRC/NRR/DLR/RPB1, "Docketing of December 14, 2009 NRC Teleconference Notes Pertaining to the License Renewal of the Duane Arnold Energy Center." (ML100070565)
01/07/2010	Note to File incl Telcon Record, Verbal Comm, from Harris B, NRC/NRR/DLR/RPB1, NRC/NRR/DLR/RPB1, "Docketing of November 12, 2009, Teleconference Notes Pertaining To The License Renewal of the Duane Arnold Energy Center." (ML100082195)

APPENDIX B: CHRONOLOGY	
Date	**Subject**
01/13/2010	Conference/Symposium/Workshop Paper Note, from Harris B K, NRC/NRR/DLR/RPB1, NRC/NRR/DLR, "Docketing of December 3, 2009 U.S. Nuclear Regulatory Commission Teleconference Notes Pertaining to the License Renewal of the Duane Arnold Energy Center." (ML100080009)
01/13/2010	Note to File incl Telcon Record, Verbal Comm, from Harris B K, NRC/NRR/DLR/RPB1, NRC/NRR/DLR, "Docketing of October 2, 2009 U.S. Nuclear Regulatory Commission Teleconference Notes Pertaining to the License Renewal of the Duane Arnold Energy Center." (ML100080034)
01/14/2010	Letter, from Costanzo C R, NextEra Energy Duane Arnold, LLC, NRC/Document Control Desk NRC/NRR, "Duane Arnold - Supplemental Information Regarding License Renewal Application." (ML100210191)
1/14/2010	Letter, from Costanzo C R, NextEra Energy Duane Arnold, LLC, NRC/Document Control Desk NRC/NRR, "Duane Arnold - Supplemental Information Regarding License Renewal Application." (ML100210191)
01/20/2010	Inspection Report Letter, from Stone A M, NRC/RGN-III/DRS/EB2, to Costanzo C R, NextEra Energy Duane Arnold, LLC, "IR 05000331-09-010 (DRS) on 11/02/09 - 12/16/09 for Duane Arnold License Renewal Inspection Program, Scoping, Screening, and Aging Management Programs." (ML100210603)
2/2/2010	Letter, from Costanzo C R, NextEra Energy Duane Arnold, LLC, NRC/Document Control Desk NRC/NRR, "Duane Arnold Energy Center, Response to Request for Additional Information for the Review of License Renewal Application - Batch 3." (ML100350390)
2/22/2010	Letter Request for Additional Information (RAI), from Harris B K, NRC/NRR/DLR/RPB1, to Costanzo C, NextEra Energy Duane Arnold, LLC, "Request for Additional Information for the Review of the Duane Arnold Energy Center License Renewal Application-Batch 4 (TAC No, MD9769)." (ML100471037)
3/9/2010	Letter Request for Additional Information (RAI), from Costanzo C R, NextEra Energy Duane Arnold, LLC, NRC/Document Control Desk NRC/NRR, "Duane Arnold Energy Center - Responses to Requests for Additional Information Regarding the Center License Renewal Application - Batch 4." (ML100700248)
4/02/2010	Letter, from Costanzo C R, NextEra Energy Duane Arnold, LLC, NRC/Document Control Desk NRC/NRR, "Supplemental Information Regarding License Renewal Application." (ML100960277)
4/28/2010	Letter, from Costanzo C R, NextEra Energy Duane Arnold, LLC, NRC/Document Control Desk NRC/NRR, "Supplemental Information Regarding License Renewal Application." (ML101190355)
5/25/2010	Letter, from Costanzo C R, NextEra Energy Duane Arnold, LLC, NRC/Document Control Desk NRC/NRR, "Comments on NRC Safety Evaluation Report with Open Items Related to the License Renewal of Duane Arnold Energy Center." (ML101760465)
7/29/2010	Letter, from Costanzo C R, NextEra Energy Duane Arnold, LLC, NRC/Document Control Desk NRC/NRR, "Supplemental Information Related to the Duane Arnold Energy Center License Renewal Application – Buried Piping." (ML1021401920)

APPENDIX B: CHRONOLOGY	
Date	**Subject**
8/16/2010	Letter Request for Additional Information (RAI), from Harris B K, NRC/NRR/DLR/RPB1, to Costanzo C, NextEra Energy Duane Arnold, LLC, "Request for Additional Information for the Review of the Duane Arnold Energy Center License Renewal Application-Low Voltage Cables (TAC No, MD9769)," (ML1022801090)
8/18/2010	Letter, from Costanzo C R, NextEra Energy Duane Arnold, LLC, NRC/Document Control Desk NRC/NRR, "Supplemental Information Related to the Duane Arnold Energy Center License Renewal Application – Buried Piping and Tanks Inspection Program." (ML1023101290)

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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**
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J. Dozier	Management Oversight
J. Davis	Management Oversight
C. Doutt	Reviewer – Electrical
B. Fu	Reviewer - Mechanical
J. Gavula	Reviewer – Mechanical
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B. Harris	Project Management
D. Hoang	Reviewer - Structural
B. Holian	Management Oversight
W. Holston	Reviewer – Mechanical
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T. Morgan	Reviewer – Structural
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APPENDIX C: PRINCIPAL CONTRIBUTORS	
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Center for Nuclear Waste Regulatory Analysis	GALL Audit and Report
Thomas Associates, Inc.	SER Support

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Appendix D

REFERENCES

This appendix lists the references used throughout this safety evaluation report (SER) for review of the license renewal application (LRA) for DAEC.

APPENDIX D: REFERENCES
10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities.”
10 CFR Part 54, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants.”
American Concrete Institute (ACI) 201.2R, “Guide to Durable Concrete.”
ACI 349.3R-96, “Evaluation of Existing Nuclear Safety-Related Concrete Structures.”
American National Standards Institute (ANSI) B31.7, “Piping Fatigue Analysis.”
American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section III
ASME Boiler and Pressure Vessel Code, Section XI
American Society for Testing and Materials (ASTM) C-33, “Standard Specification for Concrete Aggregates.”
ASTM C227-50, “Standard Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations.”
ASTM C289-64, “Standard Test Method for Potential Alkali-Silica Reactivity of Cement-Aggregates (Chemical Method).”
ASTM C295-54, “Standard Guide for Petrographic Examination of Aggregates for Concrete.”
ASTM D2276, “Standard Test Method for Particulate Contaminant in Aviation Fuel by Line Sampling.”
ASTM D6224-98, “Standard Practice for In-Service Monitoring of Lubricating Oil for Auxiliary Power Plant Equipment.”
BWRVIP-05, “Reactor Vessel Shell Weld Inspection Guidelines.”
BWRVIP-14, “Evaluation of Crack Growth in BWR Stainless Steel RPV Internals.”
BWRVIP-18, “BWR Vessel and Internals Project, BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines.”
BWRVIP-25, “BWR Core Plate Inspection and Flaw Evaluation Guidelines.”
BWRVIP-26, “BWR Vessel and Internals Project, BWR Top Guide Inspection and Flaw Evaluation Guidelines.”
BWRVIP-27, “BWR Vessel and Internals Project, BWR Standby Liquid Control System/Core Plat ΔP Inspection and Flaw Evaluation Guidelines,” EPRI TR-107286.
BWRVIP-29, “BWR Water Chemistry Guidelines – 1996 Revision.” EPRI TR-103515
BWRVIP-38, “BWR Vessel and Internals Project, BWR Shroud Support Inspection and Flaw Evaluation Guidelines,” EPRI TR-108823.
BWRVIP-41, “BWR Vessel and Internals Project, BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines.”
BWRVIP-47, “BWR Vessel and Internals Project, BWR Lower Plenum Inspection and Flaw Evaluation Guidelines.”
BWRVIP-48, “BWR Vessel and Internals Project, Vessel ID Attachment Weld and Inspection and Flaw Evaluation Guidelines.”
BWRVIP-49, “BWR Vessel and Internals Project, Instrument Penetration Inspection and Flaw Evaluation Guidelines.”
BWRVIP-59, “BWR Vessel and Internals Project, Evaluation of Crack Growth in BWR Nickel Base Austenitic Alloys in RPV Internals.”
BWRVIP-74, “BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal.” EPRI TR-113596
BWRVIP-76, “BWR Core Shroud Inspection and Flaw Evaluation Guidelines.”
BWRVIP-78, “BWR Integrated Surveillance Program Plan.”
BWRVIP-86, “BWR Vessel and Internals Project, Updated BWR Integrated Surveillance Program (ISP) Implementation Plan.”
BWRVIP-94, “BWR Vessel and Internals Project Program Implementation Guide.”

BWRVIP-100, "BWR Vessel and Internals Project, Crack Growth Rates in Irradiated Stainless Steels in BWR Internal Components."
BWRVIP-116, "BWR Vessel and Internals Project, Integrated Surveillance Program."
BWRVIP-130, "BWR Water Chemistry Guidelines – 2004 Revisions."
BWRVIP-139, "BWR Vessel and Internals Project, Steam Dryer Inspection and Flaw Evaluation Guidelines."
BWRVIP-190, "BWR Water Chemistry Guidelines – 2008 Revisions."
EPRI NP-5769, "Degradation and Failure of Bolting in Nuclear Power Plants."
EPRI NP-7079, "Air-Operated Valve Maintenance Guide."
EPRI NSAC-202L, Revision 3, "Recommendations for an Effective Flow-Accelerated Corrosion Program."
EPRI 1007820, Revision 0, "Closed Cooling Water Chemistry Guideline."
EPRI 1009743, "Aging Identification and Assessment Checklist: Mechanical Components."
EPRI 1010639, Revision 4, "Non-Class I Mechanical Implementation Guideline and Mechanical Tools."
EPRI 1013013, "An Evaluation of Flow-Accelerated Corrosion in the Bottom Head Drain Lines of Boiling Water Reactors."
EPRI 1013475, "Plant Support Engineering: License Renewal Electrical Handbook."
EPRI 1015078, "Plant Support Engineering: Aging Effects for Structures and Structural Components."
EPRI TR-104213, "Bolted Joint Maintenance and Application Guide."
EPRI TR-107396, Revision 0, "Closed Cooling Water Chemistry Guideline."
Generic Letter (GL) 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping," January 25, 1988.
GL 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," June 28, 1989
GL 89-13, "Service Water System Problems Affecting Safety-Related Equipment," July 18, 1989.
GL 98-04, "Protection for Degradation of the Emergency Core Cooling System and the Containment Spray System after a Loss-of-Coolant- Accident Because of Construction and Protective Coating Deficiencies and Foreign Material in Containment," July 14, 1998.
GL 98-05, "BWR Licensees Use of the BWRVIP-05 Report to Request Relief from Augmented Examination Requirements on Reactor Pressure Vessel Circumferential shell welds," October 11, 1998.
Information Notice (IN) 92-20, "Inadequate Local Leak Rate Testing," March 3, 1992
IN 94-63, "Boric Acid Corrosion of Charging Pump Casing Caused by Cladding Cracks," August 30, 1994.
IN 2006-01, "Torus Cracking in a BWR Mark I Containment," January 12, 2006.
NEI 95-10, Revision 6, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule," June 2005.
NUREG-0313, Revision 2, "Technical Report on Material Selection and processing Guidelines for BWR Coolant Pressure Boundary Piping," January 1988.
NUREG-0619, Revision 1, "BWR Feedwater Nozzle and Control Rod Driven Return Line Nozzle Cracking," November 1980.
NUREG-1339, "Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants," June 1990.
NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS)."
NUREG-1800, Revision 1, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," September 2005.
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If you have any questions regarding this matter, please contact the license renewal project manager, Brian Harris, at 301-415-2277 or by e-mail at Brian.Harris2@nrc.gov.

Sincerely,

/RA Melanie A. Galloway/

Brian E. Holian, Director
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-331

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