NUREG-1782

Safety Evaluation Report
Related to the License Renewal of the Fort Calhoun Station, Unit 1

Docket No. 50-285

Omaha Public Power District

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

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September 2003

ABSTRACT

This safety evaluation report (SER) documents the technical review of the Fort Calhoun Station, Unit No. 1 (FCS), license renewal application (LRA) by the U.S. Nuclear Regulatory Commission (NRC) staff (staff). By letters dated January 9 and April 5, 2002, Omaha Public Power District (OPPD or the applicant) submitted the LRA for FCS in accordance with Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54 or the Rule). OPPD is requesting renewal of the operating license for Unit 1 (license numbers DPR-40) for a period of 20 years beyond the current expiration of midnight, August 9, 2013.

The FCS site is located in Washington County, NE, on the west bank of the Missouri River, approximately 19 miles north of Omaha, NE. The construction permit was issued by NRC on June 7, 1968, and the operating license was issued August 9, 1973. The unit consists of a Combustion Engineering (CE) pressurized-water reactor (PWR) nuclear steam supply system designed to generate 1500 MW-thermal, or approximately 475 MW-electric.

This SER presents the status of the staff's review of information submitted to the NRC through August 7, 2003. In its SER issued on April 21, 2003, the staff identified open and confirmatory items that had to be resolved before the staff could make a final determination on the application. These items and their resolutions are summarized in Sections 1.5 and 1.6 of this report. The staff's final conclusion of its review of the FCS LRA can be found in Section 6 of this SER.

ABBREVIATIONS

AB-FO	auxiliary boiler fuel oil
ac	alternating current
ACI	American Concrete Institute
ACRS	Advisory Committee on Reactor Safeguards
ACSR	aluminum conductor, steel reinforced
AERM	aging effect requiring management
AFW	auxiliary feedwater
AMP	aging management program
AMR	aging management review
ANSI	American National Standards Institute
AOV	air-operated valve
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATWS	anticipated transient without scram
AWWA	American Water Works Association
B&W	Babcock & Wilcox
B&WOG	Babcock & Wilcox Owners Group
BAC	boric acid corrosion
BL	Bulletin
BTP	branch technical position
BWR	boiling-water reactor
CA	compressed air
CAP	corrective action program
CASS	cast austenitic stainless steel
CCNPP	Calvert Cliffs Nuclear Power Plant
CCW	component cooling water
CE	Combustion Engineering; control element
CEA	control element assembly
CEDM	control element drive mechanism
CEOG	Combustion Engineering Owners Group
CFR	*Code of Federal Regulations*
CI	confirmatory item
CIAS	containment isolation actuation signal
CIV	containment isolation valve
CLB	current licensing basis
CMAA	Crane Manufacturers Association of America
CQE	critical quality element
CR	condition report
CRD	control rod drive
CS	containment spray
CSB	core support barrel
CUF	cumulative usage factor
CVCS	chemical and volume control system
DBA	design-basis accident
DBD	design-basis document
DBE	design-basis event

ABBREVIATIONS (con't)

dc	direct current
DG	diesel generator
DGFO	emergency diesel generator fuel oil
DGLO	emergency diesel generator lube oil
DSS	diverse scram system
EA	engineering analysis
ECCS	emergency core cooling system
ECT	eddy current testing
EDG	emergency diesel generator
EEQ	electrical equipment qualification
EFPY	effective full-power year
EFWST	emergency feedwater storage tank
EOCI	Electric Overhead Crane Institute
EPRI	Electric Power Research Institute
EQ	environmental qualification
ESF	engineered safety feature
ESFAS	engineered safety features actuation system
FAC	flow-accelerated corrosion
FACTS	Fort Calhoun Automatic Cable Tracking System
FCS	Fort Calhoun Station, Unit 1
FHA	fire hazard analysis
FMP	fatigue monitoring program
FP	fire protection
FP-FO	fire protection fuel oil
FPP	fire protection program
FPS	feet per second
FSAR	final safety analysis report
FW	feedwater
GALL	Generic Aging Lessons Learned
GE	General Electric Co.
GEIS	generic environmental impact statement
GL	generic letter
GWD	gaseous waste disposal
HELB	high-energy line break
HEPA	high-efficiency particulate air
HPCI	high-pressure coolant injection
HPSI	high-pressure safety injection
HVAC	heating, ventilation, and air conditioning
I&C	instrumentation and control
IA	instrument air
IASCC	irradiation-assisted stress-corrosion cracking
ICI	in-core instrumentation
IEEE	Institute of Electrical and Electronic Engineers
IGA	intergranular attack
IGSCC	intergranular stress-corrosion cracking
IN	information notice

ABBREVIATIONS (con't)

IPA	integrated plant assessment
ISG	interim staff guidance
ISI	inservice inspection
LBB	leak before break
LER	licensee event report
LOCA	loss-of-coolant accident
LPSI	low-pressure safety injection
LRA	license renewal application
LRDB	license renewal database
LTOP	low-temperature overpressure protection
LWD	liquid waste disposal
MCRE	main control room envelope
MFW	main feedwater
MIC	microbiologically influenced corrosion
Mo	molybdenum
Mn	manganese
MS	main steam
MSIV	main steam isolation valve
MW	megawatt
n/cm^2	neutrons per square centimeter
NDE	nondestructive examination
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NG	nitrogen gas
Ni	nickel
NPAR	nuclear plant aging research
NPS	nominal pipe size
NRC	U.S. Nuclear Regulatory Commission
NSSS	nuclear steam supply system
OD	outside diameter
ODCM	offsite dose calculation manual
ODSCC	outer-diameter stress-corrosion cracking
OI	open item
OPPD	Omaha Public Power District
P&ID	piping and instrumentation diagram
PBD	program basis document
PM	preventive maintenance
POI	potential open item
PORV	power-operated relief valve
ppm	parts per million
PRA	probability and risk assessment; probabilistic risk assessment
PS	primary sampling
psia	pounds per square inch, atmospheric (pressure)
PS/PMP	periodic surveillance and preventive maintenance program

ABBREVIATIONS (con't)

P/T	pressure and temperature
PTS	pressurized thermal shock
PVC	polyvinyl chloride
PWR	pressurized-water reactor
PWSCC	primary water stress-corrosion cracking
QA	quality assurance
RAI	request for additional information
RAMS	resource acquisition management system
RC	reactor coolant
RCIC	reactor core isolation cooling
RCP	reactor coolant pump
RCPB	reactor coolant pressure boundary
RCS	reactor coolant system
RG	regulatory guide
RIS	Regulatory Issue Summary
RMS	radiation monitoring system
RPS	reactor protection system
RS	reactor system
RT_{NDT}	reference temperature nil ductility
RT_{PTS}	PTS reference temperature
RTD	resistance temperature detector
RV	reactor vessel; relief valve
RVI	reactor vessel internals
RVII	reactor vessel internals inspection
RVIP	reactor vessel integrity program
RW	raw water
SBO	station blackout
SC	structure and component
SCC	stress-corrosion cracking
SDC	shutdown cooling
SER	safety evaluation report
SFP	spent fuel pool
SFPC	spent fuel pool cooling
SG	steam generator
SGIS	steam generator isolation signal
SGP	steam generator program
SI	safety injection
SI&CS	safety injection and containment spray
SIAS	safety injection actuation signal
SIRWT	safety injection and refueling water tank
SMP	structures monitoring program
SO	standing order
SOC	Statements of Consideration
SOER	Significant Operating Experience Report
SPCS	steam and power conversion systems
SRP	Standard Review Plan

ABBREVIATIONS (con't)

SRP-LR	Standard Review Plan - license renewal
SSC	structures, systems, and components
SSEL	safe shutdown equipment list
SV	safety valve
T	thickness
TLAA	time-limited aging analysis
TR	topical report
UCS	Union of Concerned Scientists
UFHA	updated fire hazards analysis
UGS	upper guide structure
USAR	updated safety analysis report
USAS	United States of America Standards
USE	upper-shelf energy
UT	ultrasonic testing
VA	ventilating air
vac	volt alternating current
VCT	volume control tank
vdc	volt direct current
VHP	vessel head penetration

TABLE OF CONTENTS

SECTION 1

INTRODUCTION AND GENERAL INFORMATION

Section 1 - Table of Contents

1 Introduction and General Discussion

1.1 Introduction

This document is a safety evaluation report (SER) on the application for license renewal for the Fort Calhoun Station, Unit 1 (FCS), as filed by the Omaha Public Power District (OPPD or the applicant). By letters dated January 9 and April 5, 2002, OPPD submitted its application to the U.S. Nuclear Regulatory Commission (NRC or the Agency) for renewal of the FCS operating license for an additional 20 years. The NRC staff (the staff) prepared this report which summarizes the results of its safety review of the renewal application for compliance with the requirements of Title 10, Part 54 of the *Code of Federal Regulations* (10 CFR Part 54), "Requirements for Renewal of Operating Licenses for Nuclear Power Plants." The NRC license renewal project manager for the FCS license renewal review is William F. Burton. Mr. Burton may be contacted by calling 301-415-2853, or by writing to the License Renewal and Environmental Impacts Program, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555-0001.

In its January 9, 2002, submittal letter, the applicant requested renewal of the operating license issued under Section 104b of the Atomic Energy Act of 1954, as amended, for FCS (license number DPR-40) for a period of 20 years beyond the current license expiration of midnight, August 9, 2013. The FCS site is located in Washington County, NE, on the west bank of the Missouri River, approximately 19 miles north of Omaha, NE. Construction began on Unit 1 in June 1968, and its operating license was issued on August 9, 1973. The unit consists of a Combustion Engineering (CE) pressurized-water reactor (PWR) nuclear steam supply system (NSSS) designed to generate 1500 MW-thermal, or approximately 475 MW-electric. Details concerning the plant and the site are found in the updated safety analysis report (USAR) for the unit.

The license renewal process proceeds along two tracks which consist of (1) a technical review of safety issues and (2) an environmental review. The requirements for these reviews are stated in NRC regulations 10 CFR Parts 54 and 51, respectively. The safety review for the FCS license renewal is based on the applicant's license renewal application (LRA) and on the answers to requests for additional information (RAIs) from the staff. In meetings and docketed correspondence, the applicant has also supplemented its answers to the RAIs. Unless otherwise noted, the staff reviewed and considered information submitted through August 7, 2003. The LRA and all pertinent information and materials, including the USAR mentioned above, are available to the public for review at the NRC Public Document Room, 11555 Rockville Pike, Room 1-F21, Rockville, MD, 20852-2738 (301-415-4737/800-397-4209); the W. Dale Clark Library, 215 South 15th Street, Omaha, NE 68102; and the Blair Public Library, 210 South 17th Street, Blair, NE 68008-2055. Material related to the LRA is also available through the NRC website at www.nrc.gov

This SER summarizes the results of the staff's safety review of the FCS LRA and delineates the scope of the technical details considered in evaluating the safety aspects of FCS' proposed operation for an additional 20 years beyond the term of the current operating license. The LRA was reviewed in accordance with the NRC regulations and the guidance provided in NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants", dated July 2001 (SRP-LR).

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

Appendix A of this SER is a table that identifies the applicant's commitments associated with the renewal of the operating license. Appendix B contains a chronology of the principal correspondence between the NRC and the applicant related to the review of the application. Appendix C presents an index of the staff's RAIs and the applicant's responses. Appendix D is a list of principal contributors to the SER.

In accordance with 10 CFR Part 51, the staff prepared a draft for comment on the plant-specific supplement to the generic environmental impact statement (GEIS) that discusses the environmental considerations related to renewing the license for FCS. NUREG-1437, Supplement 12, the plant-specific draft supplement to the GEIS, was issued in January 2003. The final supplement to the GEIS was issued on August 15, 2003.

1.2 License Renewal Background

Pursuant to the Atomic Energy Act of 1954, as amended, and NRC regulations, operating licenses for commercial power reactors are issued for 40 years. These licenses can be renewed for up to 20 additional years. The original 40-year license term was selected on the basis of economic and antitrust considerations-not on technical limitations. However, some individual plant and equipment designs may have been engineered on the basis of an expected 40-year service life.

In 1982, the NRC held a workshop on nuclear power plant aging in anticipation of the interest in license renewal. That led the NRC to establish a comprehensive program plan for nuclear plant aging research (NPAR). On the basis of the results of that research, a technical review group concluded that many aging phenomena are readily manageable and do not pose technical issues that would preclude life extension for nuclear power plants. In 1986, the NRC 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 NRC published the license renewal rule in 10 CFR Part 54 (the Rule). The NRC participated in an industry sponsored demonstration program to apply the rule to a pilot plant and to develop experience to establish implementation guidance. To establish a scope of review for license renewal, the rule defined age-related degradation unique to license renewal. However, during the demonstration program, the NRC found that many aging mechanisms occur and are managed during the period of initial license. In addition, the NRC found that the scope of the review did not allow sufficient credit for existing programs, particularly the implementation of the maintenance rule, which also manages plant aging phenomena. As a result, in 1995, the NRC amended the license renewal rule. The amended 10 CFR Part 54 established a regulatory process that is simpler, more stable, and more predictable than the previous license renewal rule. In particular, 10 CFR Part 54 was amended to focus on managing the adverse effects of aging rather than on identifying age-related degradation unique to license renewal. The rule changes were intended to ensure that important systems, structures, and components (SSCs) will continue to perform their intended functions in the period of extended operation. In addition, the integrated plant assessment (IPA) process was clarified and simplified to be consistent with the revised focus on passive, long-lived structures and components (SCs).

In parallel with these efforts, the NRC pursued a separate rulemaking effort, 10 CFR Part 51, to focus the scope of the review of the environmental impacts of license renewal, in fulfillment of the NRC's responsibilities under the National Environmental Policy Act of 1969 (NEPA).

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 provide and maintain an acceptable level of safety, with the possible exception of the detrimental effects of aging on the functionality of certain plant SSCs in the period of extended operation, as well as a few other potential issues related to safety 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 defines the scope of license renewal as those SSCs (a) that are safety-related, (b) whose failure could affect safety-related functions, and (c) that are relied on to demonstrate compliance with the NRC's regulations for fire protection, environmental qualification (EQ), pressurized thermal shock (PTS), anticipated transients without scram (ATWS), and station blackout (SBO).

Pursuant to 10 CFR 54.21(a), an applicant for a renewed license must review all SSCs within the scope of the Rule to identify SCs subject to an aging management review (AMR). SCs subject to an AMR are those that perform an intended function without moving parts or without a change in configuration or properties, and that are not subject to replacement based on qualified life or specified time period. As required by 10 CFR 54.21(a), an applicant for a renewed license must demonstrate that the effects of aging will be managed in such a way that the intended function or functions of those SCs will be maintained, consistent with the current licensing basis (CLB), for the period of extended operation. Active equipment, however, is considered to be adequately monitored and maintained by existing programs. In other words, the detrimental aging effects that may occur for active equipment are more readily detectable and will be identified and corrected through routine surveillance, performance indicators, and maintenance. The surveillance and maintenance programs for active equipment, as well as other aspects of maintaining the plant design and licensing basis, are required throughout the period of extended operation. Section 54.21(d) requires that a supplement to the final safety analysis report (FSAR) contain a summary description of the programs and activities for managing the effects of aging.

Another requirement for license renewal is the identification and updating of time-limited aging analyses (TLAAs). During the design phase for a plant, certain assumptions are made about the length of time the plant will be operated; these assumptions are then incorporated into design calculations for several of the plant's SSCs. Under 10 CFR 54.21(c)(1), these calculations must be shown to be valid for the period of extended operation or must be projected to the end of the period of extended operation, or the applicant must demonstrate that the effects of aging on these SSCs will be adequately managed for the period of extended operation.

In 2001, the NRC developed and issued Regulatory Guide (RG) 1.188, “Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses.” This guide endorses an implementation guideline prepared by the Nuclear Energy Institute (NEI) as an acceptable method of implementing the license renewal rule. The NEI guideline is NEI 95-10, Revision 3, “Industry Guideline for Implementing the Requirements of 10 CFR Part 54-The License Renewal Rule,” which was issued in March 2001. The NRC also prepared the SRP-LR which, along with the RG, was used to review this application.

The OPPD is the first license renewal applicant to fully utilize the process defined in NUREG-1801, “Generic Aging Lessons Learned (GALL) Report,” dated July 2001. The purpose of GALL is to provide the staff with a summary of staff-approved aging management programs (AMPs) for the aging of most SCs that are subject to an AMR. If an applicant commits to implementing these staff-approved AMPs, the time, effort, and resources used to review an applicant’s LRA will be greatly reduced, thereby 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, and serves as a reference for both applicant and staff reviewers to quickly identify those AMPs and activities that the staff has determined will provide adequate aging management during the period of extended operation.

1.2.2 Environmental Review

The environmental protection regulation, 10 CFR Part 51, was revised in December 1996, to facilitate the environmental review for license renewal. The staff prepared a GEIS, in which it examined the possible environmental impacts associated with renewing licenses of nuclear power plants. For certain types of environmental impacts, the GEIS establishes generic findings that are applicable to all nuclear power plants. These generic findings are identified as Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B. Pursuant to 10 CFR 51.53(c)(3)(i), an applicant for license renewal may incorporate these generic findings into its environmental report. Analyses of those environmental impacts that must be evaluated on a plant-specific basis (Category 2 issues) must be included in the environmental report in accordance with 10 CFR 51.53(c)(3)(ii).

In accordance with NEPA and the requirements of 10 CFR Part 51, the staff performed a plant-specific review of the environmental impacts of license renewal, including whether new and significant information existed that was not considered in the GEIS. As part of the NRC environmental scoping process, a public meeting was held on June 18, 2002, in Omaha, NE, to identify environmental issues specific to the plant. Results of the environmental review and a preliminary recommendation with respect to the license renewal action were documented in NRC’s draft plant-specific supplement to the GEIS, which was issued by the NRC on January 6, 2003, and which was discussed at a separate public meeting held on February 26, 2003, in Omaha, NE. After consideration of the comments on the draft, NRC prepared NUREG-1437, Supplement 12, “Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants,” which was published on August 15, 2003.

1.3 Principal Review Matters

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

In 10 CFR 54.19(a), the Commission requires a license renewal applicant to submit general information. The applicant provided this general information in Section 1 of its LRA for FCS, submitted by letter dated January 9, 2002.

In 10 CFR 54.19(b), the Commission requires that license renewal applications include “conforming changes to the standard indemnity agreement, 10 CFR 140.92, Appendix B, to account for the expiration term of the proposed renewed license.” The applicant states the following in its LRA regarding this issue.

> The current indemnity agreement for Fort Calhoun Station, Unit 1 does not contain a specific expiration term for the operating license. Therefore, conforming changes to account for the expiration term of the proposed renewed license are not necessary, unless the license number is changed upon issuance of the renewed license.

The staff intends to maintain the license type and number upon issuance of the renewed license. Therefore, there is no need to make conforming changes to the indemnity agreement, and the requirements of 10 CFR 54.19(b) have been met.

In 10 CFR 54.21, the Commission requires that each application for a renewed license for a nuclear facility must contain (a) an IPA, (b) a description of CLB changes during staff review of the application, (c) an evaluation of TLAAs, and (d) an FSAR Supplement. Sections 3 and 4, as well as Sections A and B, of the LRA address the license renewal requirements of 10 CFR 54.21(a), (c), and (d), respectively.

In 10 CFR 54.21(b), the Commission requires that each year following submittal of the application, and at least 3 months before the scheduled completion of the staff’s review, an amendment to the renewal application must be submitted that identifies any change to the CLB of the facility that materially affects the contents of the license renewal application, including the FSAR Supplement. This information was provided by letter dated May 16, 2003. Therefore the requirements of 10 CFR 54.21(b) have been met.

In 10 CFR 54.22, the Commission lists requirements regarding technical specifications. In Appendix D of the LRA, the applicant stated that no changes to the FCS Technical Specifications are necessary. This adequately addresses the requirements of 10 CFR 54.22.

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

The staff's evaluation of the environmental information required by 10 CFR 54.23 is included in the draft and final plant-specific supplements to the GEIS that will state the considerations related to renewing the license for FCS. When the report of the ACRS, required by 10 CFR 54.25, is issued, it will be incorporated into Section 5 of this SER. The findings required by 10 CFR 54.29 are included as Section 6 of this report.

1.4 Interim Staff Guidance

The license renewal program is a living program. The NRC staff, industry, and other interested stakeholders gain experience and develop lessons learned with each renewed license. The lessons learned address the NRC's performance goals of maintaining safety, improving effectiveness and efficiency, reducing unnecessary regulatory burden, and increasing public confidence. The lessons learned are captured in interim staff guidance (ISG) for use by the staff and interested stakeholders until the improved license renewal guidance documents are revised.

The current set of relevant ISGs that have been issued by the staff, and the SER sections in which the issues are addressed by the staff, is provided below.

Interim Staff Guidance for License Renewal

ISG Issue (**Approved ISG No.)**	**Purpose**	**SER Section**
Station Blackout (SBO) Scoping **(ISG-02)**	The license renewal rule 10 CFR 54.4(a)(3) includes 10 CFR 50.63(a)(1)-SBO. The SBO rule requires that a plant must withstand and recover from an SBO event. The recovery time for offsite power is much faster than that of EDGs. The offsite power system should be included within the scope of license renewal.	2.5.2 3.6.2.4.4
Concrete Aging Management Program **(ISG-03)**	Lessons learned from the GALL Demonstration project indicated that GALL is not clear whether concrete needs any AMPs.	3.5.2.2.1 3.5.2.2.2 3.5.2.4.1 3.5.2.4.2

Fire Protection (FP) System Piping **(ISG-04)**	To clarify staff position for wall thinning of FP piping system in GALL AMPs (XI.M26 and XI.M27). New guidance is that there is no need to disassemble FP piping, as oxygen can be introduced in the FP piping which can accelerate corrosion. Instead, use nonintrusive method such as volumetric inspection. Testing of sprinkler heads should be performed at year 50 of the sprinkler systems service life, not at year 50 of plant operations, with subsequent sprinkler head tests every 10 years thereafter. Eliminated Halon/carbon dioxide system inspections for charging pressure, valve line ups, and automatic mode of operation test from GALL, as the staff considers these test verifications to be operational activities.	3.0.3.9

Identification and Treatment of Electrical Fuse Holder **(ISG-05)**	To include fuse holder AMR and AMP (i.e., same as terminal blocks and other electrical connections). The position includes only fuse holders that are not inside the enclosure of active components (e.g., inside of switchgears and inverters). Operating experience finds that metallic clamps (spring-loaded clips) have a history of age-related failures from aging stressors such as vibration, thermal cycling, mechanical stress, corrosion, and chemical contamination. The staff finds that visual inspection of fuse clips is not sufficient to detect the aging effects from fatigue, mechanical stress, and vibration.	3.6.2.4.5

1.5 Summary of Open Items

As a result of its review of the LRA for FCS, including additional information submitted to the NRC through August 7, 2003, the staff identified the following open items. An issue was open if the applicant had not presented a sufficient basis for resolution, or if information provided to the staff in recent applicant submittals in response to potential open items (POIs) had yet to be reviewed by the staff. Each open item was assigned a unique identifying number.

<u>Item</u> <u>Description</u>

2.2-1 During the AMR inspection and audit, the team reviewed the onsite engineering analysis (EA)-FC-00-149, “NSR Steam and Water Systems Impacting SSC Within Scope For License Renewal.” In this EA, the applicant identified piping systems and associated reference drawings for those systems that have met the 10 CFR 54.4(a)(2) criteria for spatial interaction. However, after discussions with the staff, the applicant indicated that some of these systems are already identified as being within the scope of license renewal but were not identified as being within scope in the LRA. The applicant also stated that the Flow-Accelerated Corrosion (FAC), Chemistry, General Corrosion of External Surfaces, and Structures Monitoring Programs are the applicable AMPs to manage aging effects for components in these systems.

On the basis of its review, the staff determined that the information, as provided by the applicant, was not sufficient for the staff's scoping and AMRs for these 10 CFR 54.4(a)(2) SSCs. For the additional SSCs that had been brought into scope to meet the 10 CFR 54.4(a)(2) criterion, the applicant was requested to provide scoping information to the component level equivalent to that of the original LRA. This information was necessary for the staff to be able to determine that all the components required by 10 CFR 54.4(a)(2) to be within the scope of license renewal and subject to an AMR had been correctly identified. Also, the applicant was requested to provide revised and/or new Section 2 tables, including links to Section 3 tables, so that the staff could perform an AMR to determine whether the applicant had identified the proper aging effects for the combination of the materials and environments, and had provided an adequate AMP for managing the corresponding aging effects for these SSCs.

By letter dated February 20, 2003, the staff issued POI-1(a) requesting that the applicant provide the above information. By letter dated March 14, 2003, the applicant provided the requested information. The staff reviewed the information and found that the applicant had adequately identified the SSCs within the scope of license renewal as a result of meeting the 10 CFR 54.4(a)(2) scoping criterion. POI-1(a) is resolved. However, the staff still had to review the AMR results for the additional components brought into scope and subject to an AMR to determine whether they would be adequately managed during the period of extended operation. This was identified as Open Item 2.2-1.

The staff has completed its review of the aging management information provided by the applicant and has determined that the SCs discussed above will be adequately managed during the period of extended operation. On this basis, Open Item 2.2-1 is closed.

2.2-2 Engineering Analysis (EA) FC-00-127, "Miscellaneous Systems, Penetrations, and Components," stated that the compressed air, demineralized water, and steam generator feedwater blowdown systems contain components that were functionally realigned. The team noted that this was inconsistent with LRA Table 2.2-1 and LRA Section 2.3.2.2. LRA Table 2.2-1 stated that containment isolation and/or pressure boundary components in the compressed air, demineralized water, and blowpipe systems were functionally realigned to the commodity group, "Containment Penetration and System Interface Components for Non-CQE Related System." However, LRA Section 2.3.2.2, which described this commodity group, stated that the group contains containment isolation valves (CIVs) from the feedwater blowdown, compressed air, blowpipe, and demineralized water systems, as well as the piping between the containment penetrations and the CIVs. It also stated that the demineralized water heat exchangers are included in the commodity group in order to maintain the component cooling water (CCW) system pressure boundary. LRA Table 2.2-1 and the description in LRA Section 2.3.2.2 are inconsistent in that the blowdown system was not identified in LRA Table 2.2-1 as having components that were functionally realigned. By letter dated February 20, 2003, the staff issued

POI-1(d) requesting the applicant to resolve this discrepancy between LRA Table 2.2-1 and the description in LRA Section 2.3.2.2, and to provide revised Section 2 tables and, if necessary, revised Section 3 tables to accurately describe which systems and/or components have been functionally realigned and how the components will be managed.

By letter dated March 14, 2003, the applicant responded to POI-1(d), providing revisions to LRA Table 2.2-1 and LRA Section 2.3.2.2 and an additional drawing to clearly identify the blowpipe system. On the basis of the applicant's response, POI-1(d) was resolved. However, the staff still needed to review the information provided to ensure that all components within scope and subject to an AMR had been identified. This was identified as Open Item 2.2-2.

The staff has now completed its review and confirmed that no components within these systems were omitted from scope and none that are subject to an AMR were omitted. On the basis of the staff's review, as described above, Open Item 2.2-2 is closed.

2.3.3.15-1 Section 2.3.3.15 of the LRA stated that the raw water (RW) discharge from the CCW system heat exchangers and the discharge from the direct cooling RW header flow into the circulating water discharge tunnel. Table 2.2-1 of the LRA designated the circulating water system as outside of license renewal scope without specific justification, but failure of the pressure boundary of buried piping or tunnels creates the potential for a loss of RW flow. Therefore, the location of the license renewal boundary at the discharge pipes for the RW system, rather than at the outlet from the circulating water discharge tunnel, had not been adequately justified. By letter dated February 20, 2003, the staff issued POI-3(a) requesting the applicant to justify the location of the license renewal boundary.

By letter dated March 14, 2003, the applicant responded to this POI stating that the location for the RW discharge license renewal boundary at check valves CW-188 and CW-189, upstream of the circulating water discharge tunnel, had been revised. The applicant included the circulating water discharge tunnel within the scope of license renewal as part of the intake structure. The applicant referenced a separate letter dated March 14, 2003, which included revised boundary drawing 11405-M-100 and new boundary drawing 11405-M-257, Sh. 2, as attachments. These drawings showed that a continuous flow path from the RW system to the river outfall had been included within scope for license renewal. This resolves the scoping issues associated with POI-3(a), but the expansion of scope introduced the need for evaluation of the applicant's AMR for the discharge tunnel.

In its POI response, the applicant provided the following discussion regarding the AMR of the discharge tunnel.

1. The circulating water discharge tunnel is constructed of reinforced concrete with a nominal wall thickness of 2' or greater and nominal floor/ceiling thicknesses of 2'-6" or greater throughout. The concrete circulating water discharge tunnel walls, floor and ceiling are constructed of Type B concrete in accordance with ACI 201.2R as specified in NUREG-1557.

2. The concrete is not exposed to aggressive river water or groundwater. The concrete that surrounds the embedded steel has a pH greater than or equal to 12.5. The concrete mix design specified a water-to-cement ratio of 0.44 and air entrainment of 5.00% + 1.00% for Class B concrete. The concrete at FCS was designed in accordance with ACI 318-63 (per USAR Section 5.3.1 Revision 0 and USAR Section 5.11.3.1 Revision 2).

3. The maximum flow rate in the circulating water tunnel is well below the velocity of 25 fps required to initiate abrasion. The calculated highest water velocity for a closed conduit is in the warm water recirculating tunnel at 12.6 fps. Therefore, this aging effect is not credible.

4. Per NUREG-1557, corrosion of embedded steel is not significant for concrete structures above or below grade that are exposed to a non-aggressive environment. A non-aggressive environment, as defined by NUREG-1557, is one with a pH greater than 11.5 or chlorides less than 500 ppm. NUREG-1557 also concludes that corrosion of embedded steel is not significant for concrete structures exposed to an aggressive environment but have a low water-to-cement ratio, adequate air entrainment, and designed in accordance with ACI 318-63 or ACI 349-85. A low water-to-cement ratio is defined as 0.35 to 0.45 and adequate air entrainment is defined as 3 to 6 percent. Therefore, corrosion of embedded steel is not credible.

5. The freeze/thaw exposure category is "Severe" since the concrete of concern is in direct contact with the soil. Based on recent analyses, the groundwater and river water contain minimal amounts of chlorides (8.0 ppm and 14.0 ppm respectively), sulfates (79 ppm and 229 ppm respectively), and the pH is slightly alkaline (7.48 and 8.39 respectively); therefore, the exposure category for sulfates, chlorides, and acids is "Mild", and concrete degradation is not credible for the circulating water discharge tunnel.

6. The total flow of the raw water equates to less than 5% of the total volume of the circulating water discharge tunnel.

Based on the installation conditions enumerated above, the conditions specified in NUREG-1557 have been satisfied; therefore, minimal or no aging effects will be realized in the circulating water discharge tunnel. Tunnel failure will not result in a loss of the raw water intended function during the period of extended operation. To verify this assumption, the applicant committed to performing a one-time inspection of the circulating water discharge tunnel as part of the one-time inspection program (B.3.5).

The staff evaluated the information provided in response to POI-3(a) and found that the applicant had brought the circulating water discharge tunnel within scope. Therefore, POI-3(a) was resolved. However, the staff still had to review the aging management results associated with the expanded scope. This was identified as Open Item 2.3.3.15-1.

By letter dated July 7, 2003, the applicant revised the response contained in its submittal dated March 14, 2003. The applicant has chosen to manage aging of the circulating water tunnel as part of the structures monitoring program instead of the one-time inspection program. The staff has reviewed the structures monitoring program to ensure that the scope of the program includes the circulating water tunnel. LRA Section B.2.10 describes the structures monitoring program. The program description states that it is consistent with GALL Program XI.S7, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants." The scope of GALL program XI.S7 includes intake and discharge structures. Because the circulating water tunnel is a discharge structure, it falls within the scope of XI.S7.

As stated above, the additional structural components of the circulating water discharge tunnel that were brought into scope were included and evaluated as part of the intake structure. The staff confirmed that the circulating water structural components brought into scope were already identified in LRA Table 2.4.2.3-1 for the intake structure. Therefore, the aging management results for the intake structure are applicable to the circulating water discharge tunnel. As discussed in Section 3.5.2.4.2 of this SER, the staff has concluded that the applicant has demonstrated that the aging effects associated with the components in structures outside containment (including the intake structure) will be adequately managed so that their intended functions will continue to be performed in accordance with the CLB for the period of extended operation. On this basis, the staff concludes that the components associated with the circulating water discharge tunnel, as part of the intake structure, will also be adequately managed such that the components will continue to perform their intended functions for the period of extended operation. Open Item 2.3.3.15-1 is closed.

3.0-1 In its letter dated March 14, 2003, the applicant provided revisions to many tables in LRA Sections 2 and 3. In Appendix A of the referenced letter, OPPD resubmitted LRA tables incorporating changes made since the April 2002 LRA revision. The revised tables were formatted to indicate which changes were made as a result of responses to NRC RAIs/POIs or as a result of additional applicant reviews of system EAs.

Subsequent to the submittal, the NRC project manager created a summary matrix of the LRA table changes. On May 28 and 29, 2003, the NRC conducted a public meeting to discuss the FCS SER open and confirmatory items. During the course of that meeting, the LRA table changes, and the bases for the changes, were discussed with the applicable NRC reviewers. The applicant revised the summary matrix to reflect the meeting conclusions. Appendix A of the applicant's July 7, 2003, submittal, and clarifications provided by the applicant on August 7, 2003, contain the revised summary of revisions to the FCS LRA tables matrix. The matrix columns include the line item number, the table in which the change was made, a description of the change, the reason for the change, whether the change was accepted at the public meeting, and clarification about the change where requested by the NRC reviewers.

The staff reviewed the revised information to determine whether the revisions alter the staff's conclusions as documented in the open items of the SER. As a result of its review of the revised information, the staff concludes that the revisions provided by the applicant demonstrate that the SCs at FCS that are subject to an AMR will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3). Open Item 3.0-1 is closed.

3.3.2.4.1.2-1 For the regenerative heat exchanger, which is constructed of stainless steel and exposed to chemically treated borated water, LRA Table 2.3.3.1-1 cited link 3.3.1.08 for aging management of cracking due to stress-corrosion cracking

(SCC), consistent with the GALL Report. This link stated that the aging management will consist of the chemistry program, with the effectiveness of the chemistry program verified by inspections performed using either the one-time inspection program, cooling water corrosion program, or periodic surveillance and preventive maintenance program. In discussions during the AMR inspection and audit, the applicant stated that the regenerative heat exchanger is welded such that the internals are not accessible. Due to its construction, the applicant stated that the aging management of the regenerative heat exchanger would consist of the chemistry program with further evaluation of cracking due to SCC provided by inspection of the welds via the inservice inspection (ISI) program. The applicant considered this adequate aging management to support the pressure boundary intended function of the heat exchanger shell. Though the staff agrees that this is acceptable for the external pressure boundary, the staff notes that it would not detect degradation of the regenerative heat exchanger tubes which could allow inventory to flow from the charging to the letdown side of the chemical and volume control system (CVCS). This would reduce the effectiveness of the CVCS for managing reactor coolant system (RCS) chemistry, and may also reduce the ability of the system to inject borated water during an event. Therefore, the proposed aging management may not be adequate to ensure that this intended function of the heat exchanger is maintained.

By letter dated February 20, 2003, the staff issued POI-10(b) and POI-10(i) requesting the applicant to describe inspections of the regenerative heat exchanger internals that would verify the absence of the identified aging effects, or to justify that degradation of the internals would not result in loss of function. By letter dated March 14, 2003, the applicant responded to POI-10(b) and POI-10(i), stating that a potential failure of the internal boundary between the two sides of the regenerative heat exchanger would not affect the inventory available for injection during an accident. The only function of the boundary is to provide for heat transfer during normal letdown operation. This function is not required during an accident. On the basis of its review of the information in the POI responses, the staff found that the applicant's response did not explain how the plant can withstand the regulated events if the pressure boundary fails.

This pressure boundary function is important for at least two reasons over and above the normal CVCS function of maintaining RCS water chemistry. The first reason involves getting adequate boron injection during an event. The second reason involves isolating a letdown line break, which is a containment bypass loss-of-coolant accident (LOCA) (note that the CVCS injection path is the normally used path for the controlled cooldown during Appendix R events).

With regard to injection during an event, letdown is designed to isolate during any event in which there is a need for injection. If the letdown heat exchanger tubes leak sufficiently, there could be a continued loss of inventory via the letdown flowpath because one of the two letdown isolation valves is upstream of the heat exchanger, and would be bypassed. This would leave a single valve to isolate letdown and support injection.

Letdown is also designed to isolate during any breaks in the system to stop containment bypass. Again, if the letdown heat exchanger tubes leak sufficiently, the inboard isolation valve would be bypassed and a single train/single valve would be relied on to stop the containment bypass LOCA.

On the basis of this information, the staff requested that the applicant provide additional information to demonstrate how degradation of the heat exchanger internals will not adversely impact the injection function, or to provide information on how the internals will be managed during the period of extended operation to ensure that the injection function is maintained. This was identified as Open Item 3.3.2.4.1.2-1.

By letter dated July 7, 2003, the applicant stated, in part, the following.

> ...flow through a tube leak in the regenerative heat exchanger (RHX) is not possible during design basis events (DBEs) because the letdown (tube) side of the RHX would be isolated in response to the events. This isolation would occur automatically upstream at the inboard containment isolation valve from the hot leg (TCV-202), and downstream at the outboard containment isolation valve (HCV-204). Backflow from the RCS through the RHX shell side is not possible due to the charging header check valves to the loops (CH-283 and -284) and the spray line (CH-285). Additionally, the containment isolation valves, as well as the letdown control valves (LCV-101-1 and -2), fail closed upon loss of air, loss of power, or loss of signal. The charging pumps, the RHX, and letdown are not credited in the USAR Chapter 14 safety analyses for plant shutdown nor are they used during a DBE (see Section 9.2.5 of the USAR).

The staff reviewed the information in the FCS USAR and the applicant's letter dated July 7, 2003, related to flow through the RHX tubes during design basis events or the regulated events covered by 10 CFR Part 54. The staff also considered whether the RHX tubes should be considered a design feature that was inherently credited to mitigate a release in the event of a CVCS line break (e.g., the charging line or the letdown line outside containment). The staff concludes that, due to the design of the FCS CVCS and the operation of the CVCS isolation valves, there is no credible scenario that would result in flow through the RHX tubes during design basis events or the regulated events covered by 10 CFR Part 54, and that pressure integrity of the RHX tubes is not required to isolate flow during a CVCS line break. Therefore, the staff concludes that degradation of the RHX tubes will not result in the loss of component and CVCS intended functions. Open Item 3.3.2.4.1.2-1 is closed.

3.6.2.3.1.2-1 The staff reviewed the USAR Supplement for the non-EQ cable AMP and found that the supplement did not provide an adequate description of the revised program, as required by 10 CFR 54.21(d). The applicant was requested to submit to the staff a revised USAR Supplement that is consistent with the descriptions for GALL AMPs XI.E1, XI.E2, and XI.E3 to satisfy 10 CFR 54.21(d). This was identified as Open Item 3.6.2.3.1.2-1.

By letter dated July 7, 2003, the applicant submitted the following revised USAR Supplement Section A.2.15 description that supersedes the Section A.2.15 in the LRA.

A.2.15 Non-EQ Cable Aging Management Program

> The FCS Non-EQ Cable Aging Management Program is a new program that provides aging management of (1) non-environmentally qualified electrical cables and connections exposed to an adverse localized environment caused by heat, radiation, or moisture; (2) non-environmentally qualified electrical cables used in instrumentation circuits that are sensitive to reduction in conductor insulation resistance, and are exposed to an adverse localized environment caused by heat, radiation, or moisture; and (3) non-environmentally qualified inaccessible medium-voltage cables exposed to an adverse localized environment caused by moisture and voltage exposure.
>
> Aging management is provided by the following actions:
>
> 1. Accessible electrical cables and connections installed in adverse localized environments will be inspected prior to the period of extended operation and at least once every 10 years for cable and connector jacket surface anomalies, such as embrittlement, discoloration, cracking, swelling, or surface contamination.
>
> 2. Electrical cables used in circuits with sensitive, low-level signals, such as radiation monitoring and nuclear instrumentation, are tested as part of the instrumentation loop calibration at the normal calibration frequency.
>
> 3. In-scope medium voltage cables exposed to significant moisture and significant voltage will be tested prior to the period of extended operation and at least once every 10 years to provide an indication of the condition of the conductor insulation. The test will be a state-of-the-art test at the time the test is performed.
>
> This program considers the technical information and guidance provided in NUREG/CR-5643, IEEE Std. P1205, SAND96-0344, EPRI TR-109619, and EPRI TR-103834-P1-2.

The staff reviewed the above information and finds that the revised USAR Supplement provides an adequate summary description of the revised Non-EQ Aging Management Program and that the program is consistent with GALL Programs XI.E1, XI.E2, and XI.E3. Open Item 3.6.2.3.1.2-1 is closed.

3.6.2.4.3.2-1 LRA Table 2.5.20-1 stated that electrical bus bars and bus bar standoffs have no aging effects that require management. The basis for the applicant's conclusion was unclear to the staff. By letter dated February 20, 2003, the staff issued POI-6(b) requesting the applicant to provide information on the components' materials and environments, along with the basis for concluding that these components have no plausible aging effects. By letter dated March 14, 2003, the applicant responded to POI-6(b), stating the following.

> The bus bar materials are copper and aluminum; their environment is in indoor air and outdoor air. In accordance with EPRI TR-114882, Non-Class1 Mechanical Implementation Guideline and Mechanical Tools, Revision 2, 1999, no aging effects were identified for aluminum, aluminum alloys, copper, or copper alloys (brass, bronze) in an indoor or outdoor air environment.
>
> The stand offs include fiberglass reinforced polyester resin and porcelain materials that are in ambient air external environment and are not continuously wetted. Internal environments are not applicable.
>
> Table 7-17 of EPRI NP-1558, A Review of Equipment Aging Theory and Technology lists the continuous use temperature of plastics. The continuous use

temperature [a] listed for polyester with 40% glass content is 266 °F[b] (compared with the bounding temperature value of 122 °F). Applying the Arrhenius methodology, it is clear that fiberglass reinforced polyester is acceptable. Figure C-2 of EPRI NP-1558 contains the relative radiation stability of thermosetting resins. The threshold for gamma radiation for polyester (glass filled) is 1,000,000,000 Rads (compared with the bounding 60-year radiation dose of less than 1,000 Rads).

a. Continuous use temperatures were determined as the temperatures corresponding to 100,000 hours (11.4 years) on the Arrhenius curve of the material for an endpoint of 50% reduction in tensile strength.

b. Based on retention of tensile strength taken at 500 degrees F.

On the basis of its review of the applicant's response to POI-6(b), the staff was concerned that the applicant may not have considered all the aging effects of the bus bars/ducts. The staff discussed this issue with the applicant, pointing out that the industry experience has indicated several problems with the bus bars/ducts, such as loosening of splice plate bolts, degradation of Noryl insulation, presence of moisture or debris, oxidation of aluminum electrical connections, and corrosion of metallic components. The staff requested that the applicant provide a description of the AMP used to detect the above aging effects, or provide justification why such a program is not needed. This was identified as Open Item 3.6.2.4.3.2-1.

By letter dated July 7, 2003, the applicant responded to Open Item 3.6.2.4.3.2-1, stating that when scoping and screening were performed for bus bars at FCS, as a conservative measure, all bus bars were included within the scope of license renewal, with the exception of those associated with SBO. SBO beyond the plant boundary was added later in response to a staff RAI and the NRC ISG on SBO. All of the in-plant bus bars are inside the enclosure of an active component, such as switchgear, power supplies, etc., and are considered to be piece parts of the larger assembly. Per 10 CFR 54.21, OPPD considers them outside the scope for license renewal.

The applicant stated that the SBO restoration buses (nonsegregated and iso-phase) are fed from the 161 Kv and 345 Kv transmission lines from the switchyard primary side of the transformers (auxiliary and main) and connect to the plant from the secondary side of the transformers by bus work (non-segregated from the auxiliary transformers and isophase from the main). The isophase bus, which is an aluminum tube contained in a tube-like aluminum enclosure, connects the main transformer to the main generator and to the unit auxiliary transformers. The isophase bus is continuously air-cooled and no moisture accumulation has ever been observed. The isophase bus connects from the main to the auxiliary transformers with bolted connections. The connections of the buses to the transformers are inspected and greased periodically in accordance with OPPD Substation Maintenance Department procedures. The inspections are performed on a "train outage schedule" (i.e., in one refueling outage, one bus is inspected and during the next outage, the other bus is inspected).

The auxiliary transformers utilize nonsegregated copper buses to connect to the 4160-volt distribution system. Use of flexible copper buses minimizes the effects of vibration from end devices. The connections of the buses to the transformers are inspected and greased periodically in accordance with OPPD Substation Maintenance Department procedures. The nonsegregated bus work is insulated. However, past inspections of this area revealed peeling or flaking of the insulation (inspections were performed during the early- to mid- 1970s, prior to implementation of the current Corrective Action Program). To preclude further degradation, OPPD taped a good portion of the non-segregated buses, including the affected areas. The taping was done with Bishops High Voltage tape, with the ends taped off with Scotch 88 tape. OPPD inspects these buses on a "train outage schedule." These buses are inspected using a plant maintenance procedure which inspects the bus and the switchgear cubicles associated with that bus.

The bus bars credited in the SBO restoration path are all connected to the auxiliary transformers by bolted connections. The aging of the bolted connections is managed through implementation of the OPPD Periodic Surveillance and Preventive Maintenance Program. The OPPD substation maintenance crew periodically inspects all bolted connections. The torque values of the bolted connections are also periodically checked. Routine inspection and cleaning of the buses by Substation Maintenance Department and FCS Maintenance Department crews preclude the buildup of any dirt or debris or the existence of loose bolting.

The description of the Periodic Surveillance and Preventive Maintenance Program in LRA Section A.2.18 (the USAR Supplement) is not at the level of detail that warrants mention of bus bar aging management, therefore, this section has not been revised. However, OPPD has revised the Periodic Surveillance and Preventive Maintenance Program description in LRA Section B.2.7 to include Substation–SBO Restoration in the program scope. The program's activities also check bus connectors for loss of torque and degradation of insulation wrap. The revised LRA Section B.2.7 is provided below.

B.2.7 Periodic Surveillance And Preventive Maintenance (PM) Program

The stated purpose of the PM program is to prevent or minimize equipment breakdown and to maintain equipment in a condition that will enable it to perform its normal and emergency functions. The program and the site administrative control processes provide for a systematic approach in establishing the method, frequency, acceptance criteria, and documentation of results.

The FCS Periodic Surveillance and Preventive Maintenance Program consists of periodic inspections and tests that are relied on to manage aging for system and structural components and that are not evaluated as part of the other aging management programs addressed in this appendix. The preventive maintenance and surveillance testing activities are implemented through periodic work orders that provide for assurance of functionality of the components by confirmation of integrity of applicable parameters.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Program:

The FCS Periodic Surveillance and Preventive Maintenance Program provides for periodic inspection and testing of components in the following systems and structures.

- Auxiliary Building
- Auxiliary Building HVAC
- Auxiliary Feedwater
- Chemical and Volume Control
- Component Cooling
- Containment
- Containment HVAC
- Control Room HVAC and Toxic Gas Monitoring
- Diesel Generator Lube Oil
- Duct Banks
- Emergency Diesel Generators
- Fire Protection
- Fuel Handling Equipment/Heavy Load Cranes
- Intake Structure
- Liquid Waste Disposal
- Containment Penetration, and System Interface Components for Non-CQE Systems
- Reactor Coolant
- Safety Injection and Containment Spray
- Ventilating Air
- Substation – SBO Restoration

(2) Preventive Actions:

The Periodic Surveillance and Preventive Maintenance Program includes periodic refurbishment or replacement of components, which could be considered to be preventive or mitigative actions. The inspections and testing to identify component aging degradation effects do not constitute preventive actions in the context of this element.

(3) Parameters Monitored or Inspected:

Inspection and testing activities monitor parameters including surface condition, loss of material, presence of corrosion products, signs of cracking and presence of water in oil samples.

(4) Detection of Aging Effects:

Preventive maintenance and surveillance testing activities provide for periodic component inspections and testing to detect the following aging effects and mechanisms:

- Change in Material Properties
- Cracking
- Fouling
- Loss of Material
- Loss of Material – Crevice Corrosion
- Loss of Material – Fretting
- Degradation of insulation wrap
- Loss of Material – General Corrosion
- Loss of Material - Pitting Corrosion
- Loss of Material - Pitting/Crevice/Gen. Corrosion
- Loss of Material – Wear
- Separation
- Loss of Torque

The extent and schedule of the inspections and testing assures detection of component degradation prior to the loss of their intended functions. Established techniques such as visual inspections and dye penetrant testing are used.

(5) Monitoring and Trending:

Preventive maintenance and surveillance testing activities provide for monitoring and trending of aging degradation. Inspection intervals are established such that they provide for timely detection of component degradation. Inspection intervals are dependent on the component material and environment and take into consideration industry and plant-specific operating experience and manufacturers' recommendations.

The program includes provisions for monitoring and trending with the stated intent of identifying potential failures or degradation and making adjustments to ensure components remain capable of performing their functions. PM review and update guidelines are provided that include adjustment of PM task and frequency based on the as-found results of previous performance of the PM. In particular, responsible system engineers are required to periodically review the results of preventive maintenance and recommend changes based on these reviews. The program includes guidance to assist the system engineers in achieving efficient and effective trending.

(6) Acceptance Criteria:

Periodic Surveillance and Preventive Maintenance Program acceptance criteria are defined in the specific inspection and testing procedures. They confirm component integrity by verifying the absence of the aging effect or by comparing applicable parameters to limits based on the applicable intended function(s) as established by the plant design basis.

(7) Corrective Actions:

Identified deviations are evaluated within the FCS corrective action process, which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation. The FCS corrective action process is in accordance with 10 CFR 50 Appendix B.

(8) Confirmation Process:

The FCS corrective action process is in accordance with 10 CFR 50 Appendix B and includes:

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls:

All credited aging management activities are subject to the FCS administrative controls process, which is in accordance with 10 CFR 50 Appendix B and requires formal reviews and approvals.

(10) Operating Experience:

Periodic surveillance and preventive maintenance activities have been in place at FCS since the plant began operation. These activities have a demonstrated history of detecting damaged and degraded components and causing their repair or replacement in accordance with the site corrective action process. With few exceptions, age-related degradation adverse to component intended functions was discovered and corrective actions were taken prior to loss of intended function.

Conclusion:

The Periodic Surveillance and Preventive Maintenance Program assures that various aging effects are managed for a wide range of components at FCS. Based on the program structure and administrative processes and FCS operating experience, there is reasonable assurance that the credited inspection and testing activities of the Periodic Surveillance and Preventive Maintenance Program will continue to adequately manage the identified aging effects of the applicable components so that the intended functions will be maintained consistent with the current licensing basis for the period of extended operation.

The staff reviewed the applicant's response to Open Item 3.6.2.4.3.2-1, including the revised aging management program description, and finds that the applicant has provided an acceptable aging management program to manage the aging effects associated with the bus bars/ducts. On this basis, Open Item 3.6.2.4.3.2-1 is closed.

3.6.2.4.4.2-1 The aging effect for the transmission aluminum conductor-steel reinforced (ACRS) conductor is loss of conductor strength and vibration. The applicant addressed the vibration and the aluminum portion of the conductor, but did not address the steel portion. The most prevalent mechanism contributing to loss of conductor strength is corrosion, which includes corrosion of steel core and aluminum strand pitting. The staff requested that the applicant provide a description of its AMPs used to manage the aging effects in high-voltage conductors, or provide justification for why such programs are not needed. This was identified as Open Item 3.6.2.4.4.2-1.

By letter dated July 7, 2003, the applicant explained that it had performed a thorough review of industry operating experience related to the aging effects on high-voltage components, including ACSR. A detailed discussion on surface contaminants was provided in response to POI-6a (LIC-03-0035, dated March 14, 2003). The portion of that discussion on surface contaminants also applies to ACSR steel core.

The aging effects identified for high-voltage insulators, transmission conductors, switchyard bus, and un-insulated ground conductors are not heat-related, so ohmic heating is not required to be addressed (the applicant referenced the License Renewal Electrical Handbook, Electronic Power Research Institute (EPRI) 1003057, Final Report, December 2001, page 12-2, Ohmic Heating for Power Applications).

For ACSR conductors, corrosion degradation begins as a loss of zinc from the galvanized steel core wires. Corrosion rates depend largely on air quality, which includes suspended particles, chemistry, SO_2 concentration in air, precipitation, fog chemistry, and meteorological conditions (the applicant referenced the EPRI License Renewal Electrical Handbook, pages 581 and 584). Corrosion of ACSR conductors is a very slow-acting aging effect that is even slower in rural areas which generally have less suspended particles and SO_2 concentrations in the air than urban areas. 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. As illustrated in EPRI License Renewal Electrical Handbook, Final Report 1003057, December 2001, page 13-6, there is an ample strength margin to maintain the transmission conductor intended function through the period of extended operation.

On the basis of the above, the applicant determined that corrosion on high-voltage conductors is not a significant aging mechanism at FCS, and loss of conductor strength is, therefore, not an aging effect requiring management. There are no applicable aging effects that could cause the loss of the intended function of the transmission conductors for the period of extended operation.

The staff reviewed the applicant’s response to Open Item 3.6.2.4.4.2-1 and agrees that the information provided in the EPRI electrical handbook confirms that there is adequate margin to maintain the conductor function through the period of extended operation, and finds that the applicant has provided an acceptable justification for not providing aging management for the ACSR conductor. The staff Open Item 3.6.2.4.4.2-1 is closed.

3.6.2.4.5.2-1 In LRA Section 2.5.1, “Cables and Connectors,” the applicant identified fuse blocks as components within the scope of license renewal and subject to an AMR. The staff was unsure whether fuse holders were included within the component type, “Fuse Block.” By letter dated February 20, 2003, the staff issued POI-1(c) requesting the applicant to clarify whether fuse holders are within the scope of license renewal and subject to an AMR, and, if fuse holders are brought into scope and require aging management, to provide the associated aging management information.

By letter dated March 14, 2003, the applicant provided the following requested information.

> Fuse holders are in the scope of license renewal as part of the cable and connector scoping and screening analysis. There are no fuse holders attached to electrical penetrations at FCS. Fuse holders at FCS that are within active enclosures such as power supplies, switchgear, and Motor Control Centers are considered outside the scope for license renewal. There are no fuse holders at FCS exposed to vibration or environments that would cause corrosion, chemical contamination, or oxidation of the connecting surfaces. Fuse holders within enclosures that are not considered active and subject to mechanical stress, fatigue and electrical transients will be included in the Fatigue-Monitoring Program(B.2.4).

The staff reviewed the applicant’s response to POI-1(c) regarding whether fuse holders within the enclosures are considered active and whether they are subject to stress and fatigue. The staff discussed this issue with the applicant. The applicant believed that there are no fuse holders that would fall within the definition of being in an outside environment that would need aging management review, but was not sure. The staff was still unclear regarding the aging management of fuse holders. ISG-5, “Identification and Treatment of Electrical Fuse Holders,” which discusses scoping, screening, and aging management of fuse holders, states that fuse holders inside the enclosure of an active component, such as switchgear, power supplies, power inverters, battery chargers, and circuit boards, are considered to be piece parts of the larger assembly, and thus 10 CFR 54.21 considers them outside the scope for license renewal. The staff requested that the applicant make a positive statement that all fuse holders are within active enclosures and hence are not within scope and need not be subject to an AMR. If the applicant cannot make this statement, the staff requested that the applicant clarify how fuse holders within the scope of license renewal and subject to an AMR will be managed during the period of extended operation. The staff was also concerned that the applicant may have missed fuse holders which are used in circuits to isolate safety loads from non-safety loads. The staff requested that the applicant investigate and confirm whether any fuse holders fall into this category. These issues were identified as Open Item 3.6.2.4.5.2-1.

By letter dated July 7, 2003, the applicant clarified that fuse blocks (fuse holders) at FCS are either in active components (panels, switchgear, or cabinets), which are outside the scope of license renewal, or are in enclosures (junction boxes) that are in controlled environments. The applicant stated that it will manage the aging of fuse holders in accordance with ISG-5.

Further, the applicant clarified that FCS does not have any fuse holders in circuits used to isolate safety loads from non-safety loads that are in areas of environmental extremes or that are subject to aging management.

On the basis of the applicant's response to Open Item 3.6.2.4.5.2-1, the staff concludes that the applicant has clarified which fuse holders are within scope and has clarified that management of fuse holders within the scope of license renewal and subject to an AMR will be done in accordance with ISG-5. The staff finds this acceptable. Finally, the applicant has clarified that there are no fuse holders that are used to isolate safety and non-safety loads that are subject to an AMR. The staff finds this acceptable. On this basis, Open Item 3.6.2.4.5.2-1 is closed.

4.7.2.2-1 The staff has evaluated the information provided by the applicant in its LRA and in its response to RAI 4.7.2-1. The staff has concluded that the applicant appropriately identified those TLAAs (fatigue crack growth, aging of cast austenitic stainless steel (CASS) RCS piping and components, and primary water stress-corrosion cracking (PWSCC) of Inconel 82/182 RCS welds), which may impact the extension of the applicant's existing leak before break (LBB) analysis through the period of extended operation. The applicant has committed to perform a plant-specific LBB analysis prior to entering the period of extended operation which will address these TLAAs and project the analysis to the end of the period of extended operation. However, the applicant's commitment did not appear to meet 10 CFR 54.21(c)(1) which requires the applicant to demonstrate that (i) the analysis remains valid for the period of extended operation, (ii) the analysis has been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff requested that the applicant provide the information needed for the staff to determine whether (i) the applicant's LBB analysis remains valid for the period of extended operation, (ii) the applicant's LBB analysis has been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) of the components within the scope of the LBB analysis will be adequately managed for the period of extended operation. This was identified as Open Item 4.7.2.2-1.

NEI 95-10, Revision 3, provides guidance to applicants who apply for renewal of their operating licenses. In Regulatory Guide 1.188, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses," the staff has endorsed this NEI guideline. Section 5.1.4 of NEI 95-10 allows for deferral of TLAA evaluations. The guidance states that, if an applicant decides to defer the completion of an evaluation, it should submit additional information to the staff to support a conclusion that the effects of aging addressed in the TLAA will be adequately managed. This information includes (1) details of the methodology that will be used for the TLAA evaluation, (2) the acceptance criteria that will be used to judge the adequacy of the structure or component, consistent with the CLB, when the TLAA evaluation or analysis is performed, (3) the corrective actions that will be performed to provide reasonable assurance that the structure or component will perform its intended function or will not be outside of its design basis established by the CLB, and (4) information to identify when the completed TLAA evaluation will be submitted to ensure that the evaluation will be performed before the structure or component will be unable to perform its intended function.

By letter dated July 7, 2003, the applicant stated that it will defer completion of the plant-specific LBB evaluation in accordance with Section 5.1.4 of NEI 95-10. The applicant submitted the information below, as provided in NEI 95-10.

- The applicant committed to complete a plant-specific LBB evaluation of the RCS piping using the latest LBB criteria. The LBB analysis will incorporate the effects of thermal aging, plant-specific materials, operating temperatures/pressures, loads at welds in the primary loops, and weld fabrication. The plant-specific methodology will also use the existing plant's RCS leak detection capability and the piping stress analysis loads for the FCS RCS configuration. The analysis will be applicable for the period of extended operation, and will use a methodology from the Westinghouse Electric Company for thermal aging considerations. Westinghouse has performed over 30 plant-specific LBB analyses approved by the NRC, and addressed thermal aging effects of the cast materials as applicable. For the primary loop piping, the latest LBB SER which includes the Westinghouse analysis methodology was for D.C. Cook Units 1 and 2. This SER was issued in December 1999 (docket numbers 50-315 and 50-316).

The staff reviewed this information and finds that it adequately describes the methodology that will be used for the applicant's LBB analysis.

- Acceptance criteria used to determine the adequacy of the structure or component when the LBB analysis is performed will be in accordance with draft Standard Review Plan (SRP) 3.6.3, "Leak-Before-Break Evaluations Procedures," published for comment in Volume 52, Number 167 of the *Federal Register*, dated, Friday, August 28, 1987, and NUREG-1061, Volume 3.

The staff reviewed this information and finds that the applicant has identified the acceptance criteria that will be used to judge the adequacy of the structures or components when the LBB analysis is performed.

- The plant-specific LBB analysis will include evaluation of corrective actions that can be performed to provide reasonable assurance that the component in question will perform its intended function when called upon, or will not be outside of its design basis established by the plant's CLB. One such corrective action is to maintain the CLB RCS leak rate program as defined in FCS Technical Specification (TS) 2.1.4 during the period of extended operation. The leak detection capability of the systems noted in TS 2.1.4 meet the intent of Regulatory Guide 1.45 and will be capable of performing their designed function during the period of extended operation.

The staff reviewed this information and finds that the applicant has identified the corrective actions it will perform to ensure that the structures and components will continue to perform their intended functions.

- The applicant committed to submit a License Amendment Request containing the plant-specific LBB evaluation described above to the NRC no later than December 2006, which is well before the period of extended operation. This submittal schedule supports the applicant's planning decisions for possible changes to RCS operation or configuration.

The staff reviewed this information and finds that the applicant has identified the submittal date for the LBB analysis. Further, the staff concludes that this submittal date should provide sufficient time to address aging issues before loss of intended function of the applicable SCs.

On the basis of the applicant's response to Open Item 4.7.2.2-1, the staff concludes that the applicant has followed the guidance to support the deferral of the submittal of its LBB analysis. The characteristics of the LBB analysis, as proposed by the applicant, is sufficient to allow the staff to determine whether the analysis, when submitted, is adequate to demonstrate that the analysis has been projected to the end of the period of extended operation, as required by 10 CFR 54.21(c)(1)(ii). Open Item 4.7.2.2-1 is closed.

4.7.4-1 The application did not initially discuss an Alloy 600 repair in the temperature nozzle in the pressurizer lower shell. This was identified as new Open Item 4.7.4-1. As a result of discussions between the staff and the applicant, the applicant, in a letter dated July 7, 2003, added a new Section 4.7.4 to the license renewal application. This section indicates that the temperature nozzle in the pressurizer lower shell was repaired by adding a weld pad to the existing weld build-up to the lower shell outer diameter (OD) and welding this pad to the existing nozzle. This moved the pressure boundary from the inner diameter to this location. The Alloy 600 J-weld and original crack were left in place at the inside surface of the pressurizer as part of the repaired configuration.

In a letter dated October 25, 2000, Westinghouse provided Omaha Public Power District (OPPD) the technical justification for the weld on the liquid space Alloy 600 instrument nozzle on the OD of the pressurizer. This letter stated that the subject repair should be made in accordance with later editions of Section III, or the 1992 Edition (or later) of Section XI.

In April 2002, Westinghouse notified OPPD that its technical justification of October 2000 only considered the effects of the repair on the requirements of ASME Section III, and did not consider the Section XI requirements related to leaving the flaw in place after the repair was completed and the vessel returned to service.

In April 2003, OPPD received the "calculation note" titled "Evaluation of Fatigue Crack Growth of Postulated Flaw at Omaha Fort Calhoun Pressurizer Lower Shell Instrumentation Nozzle," dated January 8, 2003, that evaluated the Section XI requirements related to leaving the flaw in place after the repair was completed and the vessel returned to service.

OPPD has evaluated the crack, and any potential future growth of the crack, and determined it does not impact the structural integrity of the vessel for the current licensed 40-year life. OPPD has elected to defer completion of the evaluation that demonstrates that the crack, and any potential future growth of the crack, does not impact the structural integrity of the vessel for the period of extended operation. On the basis of guidance in Section 5.1.4 of NEI 95-10, Revision 3, the applicant provided details to explain how the effects of aging will be addressed for this evaluation.

OPPD will submit, for staff review and approval, the fracture mechanics evaluation of the small-bore instrument nozzle J-weld region at the repaired instrument nozzle for the period of extended operation. This submittal will be made prior to entering the period of extended operation. This evaluation will include bounding the flaw size by the size of the J-weld itself, and addressing the possibility of corrosion in the presence of a flaw.

10 CFR 54.3 contains six criteria that must be satisfied for an analysis to be considered a time-limited aging analysis (TLAA). As a result of the information submitted in its July 7, 2003 letter, the applicant's evaluation of flaw growth for a crack that was left in place at the inside surface of the pressurizer and the impact of corrosion on the pressurizer nozzle meet these six criteria and should be considered a TLAA.

Section 5.1.4 of NEI 95-10, Revision 3, indicates that an applicant who elects to defer completing the evaluation of a TLAA at the time of a renewal application should submit the following details in the renewal application to support a conclusion that the effects of aging addressed by that TLAA will be managed for a specific structure or component:

- Details concerning the methodology which will be used for TLAA evaluation,

- Acceptance criteria that will be used to judge the adequacy of the structure or component, consistent with the CLB, when the TLAA evaluation or analysis is performed,

- Corrective actions that the applicant could perform to provide reasonable assurance that the component in question will perform its intended function when called upon, or will not be outside of its design basis established by the plant's CLB, and

- Identification of when the completed TLAA evaluation will be submitted to ensure that the necessary evaluation will be performed before the structure or component in question would not be able to perform its intended functions established by the CLB.

The July 7, 2003 letter contains a methodology and criteria for evaluating the impact of flaw growth on the original crack that was left in place at the inside surface of the pressurizer and specifies that the impact of corrosion will be included in the evaluation. The methodology is summarized as follows:

1. Design drawings are reviewed to determine vessel, nozzle and J-weld dimensions and materials.

2. The initial flaw size to be used in the evaluation is calculated.

3. Manufacturing records are reviewed to determine the reference temperature (RT_{NDT}) of the base metal at the location of interest.

4. Design operation transients are reviewed to determine their appropriateness for use in the generation of stresses for use in the flaw analysis.

5. When the design transients are not appropriate, a realistic bounding transient is developed for analysis purposes.

6. Thermal transient analyses are performed to determine through-wall temperatures for use in the stress analysis.

7. Stress analyses are performed at various time points during each plant operating event of interest.

8. Pressure and mechanical load stresses are calculated.

9. A survey of the combined pressure, thermal, and mechanical stresses is conducted to determine the limiting time point for evaluation.

10. Stresses are determined to calculate the applied stress intensity factor, K_I.

11. The applied stress intensity factor is calculated for comparison to allowable values.

12. Fatigue crack growth of the flaw is calculated over the 60 years.

13. The final flaw size is used to confirm flaw stability over the remaining life of the plant.

14. The flaw stability checks defined above are performed for normal and upset conditions and emergency and faulted conditions using the respective allowables defined per ASME Section XI.

15. Primary stress limits per NB-3000 are checked considering the effect of the final flaw size.

This methodology is acceptable because it will determine the impact of plant operation, design transients, material fracture resistance, and flaw growth on pressurizer integrity for the period of extended operation.

The flaw will be acceptable if it satisfies the linear elastic fracture mechanics criteria in ASME Code Section XI, IWB-3611 or IWB-3612, or elastic-plastic fracture mechanics criteria in ASME Code Section XI, Appendix K, articles K-2200, K-2300, and K-2400. Since the acceptance criteria are in accordance with ASME Code criteria, they are acceptable for use in this TLAA.

By limiting pressure and the maximum rate of decrease in temperature for the pressurizer, the corrective action will limit the stresses on the flaw remaining in the pressurizer and provides reasonable assurance that the component in question will perform its intended function when called upon or will not be outside of the design basis established by the plant's CLB.

The applicant indicates that the TLAA for this issue will be completed before the period of extended operation and the analyses will be submitted for staff review and approval.

By satisfying the criteria in Section 5.1.4 of NEI 95-10, Revision 3, the staff concludes that the applicant has provided a methodology and criteria for assuring that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation and has satisfied the TLAA criteria 10 CFR 54.21(c)(1)(iii). The applicant's commitment to complete the evaluation is documented in Appendix A of this SER.

The applicant's corrective action includes assuring that the pressure at any temperature should not be any higher than the higher of the following two limits:

1. The saturation pressure plus 200 psi, and

2. 350 psi and the maximum rate of temperature decrease is 200 ^{o}F/hr.

On the basis of the staff's evaluation described above, the summary description for the "Pressurizer Alloy 600 J-Weld Left in Place" described in the USAR Supplement (LRA, Appendix A.3.6.4) is acceptable. Open Item 4.7.4-1 is closed.

1.6 Summary of Confirmatory Items

Confirmatory items are items for which the staff and the applicant have reached a satisfactory resolution, but the resolution has not yet been formally submitted to the staff.

As a result of its review of the LRA for FCS, including additional information submitted to the NRC through August 7, 2003, the staff identified the following confirmatory items. An issue was confirmatory if the staff and applicant had agreed on a resolution to an the issue, but the applicant had not yet formally provided the resolution for staff review. Each confirmatory item was assigned a unique identifying number.

<u>Item</u> <u>Description</u>

2.1.3.1.2-1 As part of its review of the implementation and results of the applicant's scoping activities, the staff performed a license renewal scoping and screening inspection at the FCS site during the week of November 8, 2002, and an inspection of the applicant's AMPs during the weeks of January 6 and January 20, 2003. The inspectors reviewed the applicant's engineering evaluations, documentation of the portions of the systems added to scope, and selected layout markup drawings. The inspectors also discussed the process with the cognizant individuals responsible for the evaluations. Additionally, the NRC inspectors performed walkdowns of selected areas of the plant containing SSCs of interest. The inspection team identified one item which should be considered by the applicant for inclusion within scope based on the 10 CFR 54.4(a)(1) criterion. Inspection Open Item 50-285/02-07-02 identified unqualified safety injection tank level and pressure indicators that should be considered in the scope of license renewal. These indicators are used to ensure that assumptions are met for the mitigation analysis for a LOCA. The applicant reviewed this issue and committed to include these components within scope. This was identified as Confirmatory Item 2.1.3.1.2-1.

By letter dated July 7, 2003, the applicant included the safety injection tank level and pressure indicators in scope. The applicant noted that these components were subsequently screened out as active components, resulting in no changes to the LRA. The staff finds the applicant's inclusion of the components within the scope of license renewal and the screening out of the components as active to be acceptable. Confirmatory Item 2.1.3.1.2-1 is closed.

3.0.3.12.2-1 During the staff's AMR inspection, the applicant committed to revise the general corrosion of external surfaces program to include the spent fuel pool cooling system. This was identified as Confirmatory Item 3.0.3.12.2-1.

By letter dated July 7, 2003, the applicant made the revision, noting that the spent fuel pool heat exchanger is the only system component within scope that is fabricated from carbon steel. All other system components are fabricated from stainless steel. Therefore, the heat exchanger shell requires external surface aging management for loss of material.

On the basis of the applicant's revision to the general corrosion of external surfaces program, the staff concludes that the AMP will provide adequate aging management for the components of the spent fuel pool cooling system. Confirmatory Item 3.0.2.12.2-1 is closed.

4.3.2-1 Section 4.3.2 of the LRA contained a discussion of the proposed AMP to address fatigue of the FCS pressurizer surge line. The discussion indicated that the AMP will consist of an inspection program. The LRA also indicated that the results of the surge line inspections will be used to assess the appropriate approach for addressing environmentally-assisted fatigue of the surge lines. However, Section 4.3.3 of the LRA indicated that a reevaluation of the fatigue usage of critical areas of the surge line will be performed prior to the period of extended operation and that the bounding locations will be included in the Fatigue Monitoring Program (FMP). In RAI 4.3.2-3, the staff requested that the applicant describe how the effect of the reactor water environment will be considered in the reevaluation of the critical areas of the surge line and how the results of this evaluation will be monitored by the FMP.

The applicant's December 19, 2002, response indicated that the limiting surge line welds would be inspected prior to the period of extended operation. The applicant further indicated that the results of these inspections will be used to assess the appropriate approach for addressing environmentally-assisted fatigue of the surge lines. The applicant indicated that the approach would include one or more of the following four options.

1. further refinement of the fatigue analysis to lower the Cumulative Usage Factor (CUF) to below 1.0
2. repair of the affected locations
3. replacement of the affected locations
4. management of the effects of fatigue by an inspection program that has been reviewed and approved by the NRC (e.g., periodic nondestructive examination of the affected locations at inspection intervals to be determined by a method accepted by the NRC)

The applicant committed that, if Option 4 were to be selected, it will provide the inspection details, including scope, qualification method, and frequency, to the NRC staff for review and approval prior to the period of extended operation. An AMP under this option would be a departure from the design basis CUF evaluation described in the USAR Supplement, and therefore would require a license amendment pursuant to 10 CFR 50.59. This was identified as Confirmatory Item 4.3.2-1.

By letter dated July 7, 2003, the applicant formalized this commitment. The staff finds this acceptable. Confirmatory Item 4.3.2-1 is closed.

4.3.2-2 Section 4.3.4 of the LRA contained a discussion of the analysis of Class II and III components at FCS. American National Standards Institute (ANSI) B31.1 requires that a reduction factor be applied to the allowable bending stress range if the number of full-range thermal cycles exceeds 7000. The LRA indicated that the United States of America Standards (USAS) B31.1 limit of 7000 equivalent full-range cycles may be exceeded during the period of extended operation for the sampling system and that the affected portions of the NSSS sampling system would be tracked by the FMP. In RAI 4.3.4-1, the staff requested that the applicant provide the calculated thermal stress range for these affected portions of the NSSS sampling system.

The applicant's December 12, 2002, response indicated that the small bore piping at FCS was designed and supported based on nomographs developed in accordance with the USAS B31.1 code. As a consequence, there were no specific stress calculations. The applicant committed that, as part of the FMP, the sampling piping will be analyzed and a stress calculation performed to determine the thermal stress range for the line. The applicant should confirm that the results, when completed, will meet USAS B31.1. This was identified as Confirmatory Item 4.3.2-2.

By letter dated July 7, 2003, the applicant formalized this commitment and confirmed that the stress calculation results for the small bore sampling system piping, when completed, will meet USAS B31.1 requirements. The staff finds this acceptable. Confirmatory Item 4.3.2-2 is closed.

1.7 Summary of Proposed License Conditions

As a result of the staff's review of the FCS application for license renewal, including the additional information and clarifications submitted subsequently, the staff identified two proposed license conditions. The first license condition requires the applicant to include the USAR Supplement in the next USAR update required by 10 CFR 50.71(e) following issuance of the renewed license. The second license condition requires that the future inspection activities identified in the USAR Supplement be completed prior to the period of extended operation.

SECTION 2

STRUCTURES AND COMPONENTS SUBJECT TO AN AGING MANAGEMENT REVIEW

Section 2 - Table of Contents

2 Scoping and Screening Methodology for Identifying Structures and Components Subject to an Aging Management Review, and Implementation Results

This section documents the staff's review of the methodology used by the applicant to identify structures, systems, and components (SSCs) that are within the scope of the Rule, and to identify structures and components (SCs) that are within the scope of the Rule and are subject to an aging management review (AMR). SCs subject to an AMR are those that perform an intended function, as described in Title 10 of the *Code of Federal Regulations* (CFR) Part 54 (the Rule), and meet the following two criteria:

1. They perform such functions without moving parts or without a change in configuration or properties, as set forth in 10 CFR 54.21(a)(1)(i) (denoted as "passive" SCs),

2. They are not subject to replacement based on a qualified life or specified time period, as set forth in 10 CFR (a)(1)(ii) (denoted as "long-lived" SCs).

The identification of the SSCs within the scope of license renewal is called "scoping." For those SSCs within the scope of license renewal, the identification of "passive," "long-lived" SCs that are subject to an AMR is called "screening."

The staff's review of the scoping and screening methodology is presented in Section 2.1 of this SER. The staff's review of the results of the implementation of the scoping and screening methodology is presented in Sections 2.2 through 2.5 of this SER.

By letters dated January 9 and April 5, 2002, the applicant submitted its request and application for renewal of the operating license for Fort Calhoun Station, Unit 1 (FCS). As an aid to the staff during the review, the applicant provided evaluation boundary drawings that identify the functional boundaries for systems and components within the scope of license renewal. These evaluation boundary drawings are not part of the license renewal application (LRA).

On October 11, 2002, the staff issued requests for additional information (RAIs) regarding the applicant's methodology for identifying SSCs at FCS that are within the scope of license renewal and subject to an AMR and the results of the applicant's scoping and screening process. By letters dated November 22, December 12, and December 19, 2002, the applicant provided responses to the RAIs.

The staff conducted a scoping and screening inspection from November 4-8, 2002, to examine activities that supported the LRA, including the inspection of procedures and representative records and interviews with personnel regarding the process of scoping and screening of components in select plant equipment to select SSCs within the scope of the Rule and subject to an AMR. The inspection team found several SSCs which the applicant reviewed and concluded that the SSCs were outside the scope of license renewal. The inspection team concluded that these SSCs should be within scope and informed the applicant. The applicant agreed to include the additional SSCs. When such SSCs were found, the inspection team expanded its inspection to determine whether additional SSCs had been omitted. In each case, no additional SSCs were found to be omitted from scope. On this basis, the NRC staff concluded that the applicant's scoping and screening process was successful in identifying those SSCs required to be considered for aging management. In addition, for a sample of plant systems, the inspection team performed visual examinations of accessible portions of the systems to observe any effects of equipment aging. Finally, the inspection concluded that the scoping and screening portion of the applicant's license renewal activities were conducted as described in the LRA and that documentation supporting the application is in an auditable and retrievable form. Inspection open items that were identified during the inspection are discussed in this SER.

2.1 Scoping and Screening Methodology

2.1.1 Introduction

The Rule requires that each application for license renewal contain an integrated plant assessment (IPA). Furthermore, the IPA must list and identify those SCs that are subject to an AMR from the SSCs that are within the scope of license renewal.

In Section 2.1, "Scoping and Screening Methodology," of the LRA, the applicant described the scoping and screening methodology used to identify SSCs at FCS that are within the scope of license renewal and SCs that are subject to an AMR. The staff reviewed the applicant's scoping and screening methodology to determine if it meets the scoping requirements stated in 10 CFR 54.4(a) and the screening requirements stated in 10 CFR 54.21.

In developing the scoping and screening methodology for the FCS LRA, the applicant considered the requirements of the Rule, the statements of consideration (SOCs) for the Rule, and the guidance presented in Nuclear Energy Institute (NEI) 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule," Revision 3, March 2001. In addition, the applicant also considered the NRC staff's correspondence with other applicants and with the NEI in the development of this methodology.

2.1.2 Summary of Technical Information in the Application

In Sections 2.0 and 3.0 of the LRA, the applicant provides the technical information required by 10 CFR 54.21(a). In LRA Section 2.1, "Scoping and Screening Methodology," the applicant describes the process used to identify the SSCs that meet the license renewal scoping criteria under 10 CFR 54.4(a), as well as the process used to identify the SCs that are subject to an AMR as required by 10 CFR 54.21(a)(1).

Additionally, Section 2.2 ("Plant Level Scoping Results), Section 2.3 ("System Scoping and Screening Results: Mechanical Systems"), Section 2.4 ("Scoping and Screening Results: Structures"), and Section 2.5 ("Scoping and Screening Results: Electrical) of the LRA amplify the process that the applicant uses to identify the SCs that are subject to an AMR. Chapter 3 of the LRA, "Aging Management Review," contains the following information: Section 3.1, "Aging Management of Reactor Coolant Systems"; Section 3.2, "Aging Management of Engineered Safety Features Systems"; Section 3.3, "Aging Management of Auxiliary Systems"; Section 3.4, "Aging Management of Steam and Power Conversion Systems"; Section 3.5, "Aging Management of Containment, Structures, and Component Supports"; and Section 3.6, "Aging Management of Electrical and Instrumentation and Controls." Chapter 4 of the LRA, "Time-Limited Aging Analyses," contains the applicant's identification and evaluation of time-limited aging analyses (TLAAs).

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

In LRA Section 2.1.3, "Current Licensing Basis Information," the applicant described the use of the Critical Quality Elements (CQE) list, which is the FCS safety classification system, as the source of current licensing basis (CLB) information for determining the correlation between the safety classifications and quality assurance classifications in the CLB.

In LRA Sections 2.1.3.3, "Comparison," 2.1.4, "Plant Level Scoping of Systems and Structures," and 2.1.5, "Scoping of System/Structure Components," the applicant discussed the scoping methodology as it related to safety-related criteria, in accordance with 54.4(a)(1). With respect to the safety-related criteria, the applicant stated that the SSCs within the scope of license renewal include safety-related SSCs that were determined by carefully reviewing the definitions provided in the Rule relative to FCS classifications embodied in the CQE list and FCS safety classification system. The applicant stated that the SSCs designated as CQE satisfy the 10 CFR 54.4(a)(1) requirements, and SSCs designated as Limited CQE (LCQE) satisfy the 10 CFR 54.4(a)(2) requirements. The CQE list also identifies as CQE vital auxiliaries such as electric power distribution, cooling water, and heating, ventilation, and air conditioning (HVAC) systems that are required for mitigation of design basis events (DBEs). By relying on the CQE list, all CQE SSCs will be identified, as well as all SSCs that could fail and prevent the functioning of CQE SSCs.

In LRA Sections 2.1.3.3, "Comparison," 2.1.4, "Plant Level Scoping of Systems and Structures," and 2.1.5, "Scoping of System/Structure Components," the applicant discussed the scoping methodology as it related to the non-safety-related criteria in accordance with 10 CFR 54.4(a)(2). With respect to the non-safety-related criteria, the applicant stated, in part, that a review has been performed to identify the non-safety-related SSCs whose failure could prevent satisfactory accomplishment of the safety-related intended functions identified in 10 CFR 54.4(a)(1). The review considered two categories of potential SSCs: (1) non-safety-related SSCs that functionally support the operation of safety-related SSCs, and (2) non-safety-related SSCs whose failure could cause an interaction with safety-related SSCs and potentially result in the failure of the safety-related SSCs to perform their intended safety function(s). For the first category, the applicant has conservatively assumed that non-safety-related piping and supports beyond the safety-related/non-safety-related boundary meet the 10 CFR 54.4(a)(2) criterion and are included in scope. For the second category, the applicant performed a systematic review of potential non-safety-related/safety-related interactions and relied on the LCQE designation for components in the FCS Resource Acquisition Management System (RAMS). The applicant stated that all high-energy piping and certain design features such as piping supports, pipe whip restraints, and internal barriers, as well as certain non-safety-related piping segments and structures, should be brought into scope to meet the requirements.

In LRA Sections 2.1.4, "Plant Level Scoping of Systems and Structures," and 2.1.5, "Scoping of System/Structure Components," the applicant discussed the scoping methodology as it related to the regulated event criteria in accordance with 10 CFR 54.4(a)(3). With respect to the scoping criteria related to 10 CFR 54.4(a)(3), the applicant reviewed all non-CQE SSCs relied on in safety analyses or plant evaluations to perform an intended function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), environmental qualification (10 CFR 50.49), pressurized thermal shock (10 CFR 50.61), anticipated transients without scram (10 CFR 50.62), and station blackout (10 CFR 50.63) to ensure they were adequately accounted for in the scoping methodology. To support this review, the applicant assembled and evaluated source documentation developed as part of the applicant's initial response to these specific requirements including USAR sections, design-basis documents (DBDs), design drawings, component databases, and docketed correspondence, including regulatory commitments to the NRC to address each requirement. Additionally, the applicant evaluated specific topical source information pertaining to each regulated event including: fire hazards analysis (FHA), safe shutdown equipment list (SSEL), Environmental Qualification (EQ) Manual, station blackout (SBO) coping assessment, and anticipated transient without scram (ATWS) assessment. These source documents presented detailed design information for each regulated event and provided an additional source of information to identify SCs credited for mitigation of the events of interest. In summary, the SSCs relied on in safety analyses or plant evaluations to perform an intended function that demonstrates compliance with NRC regulations for fire protection (FP), EQ, pressurized thermal shock (PTS), ATWS, and SBO, have been included in the scope of license renewal in accordance with the criteria of 10 CFR 54.4(a)(3).

2.1.2.2 Documentation Sources Used for Scoping and Screening

In LRA Sections 2.1.4, "Plant Level Scoping of Systems and Structures," and 2.1.5, "Scoping of System/Structure Components," the applicant stated information derived from the Updated Safety Analysis Report (USAR), DBDs, CQE list, RAMS, Fort Calhoun Automatic Cable Tracking System (FACTS), SSEL, FHA, FCS EQ Manual, FCS final design package for the diverse scram system (DSS), and the SBO coping assessment contained in an FCS engineering analysis (EA) was reviewed during the license renewal scoping and screening process. The applicant used this information to identify the functions performed by plant systems and structures. These functions were then compared to the scoping criteria in 10 CFR 54.4(a)(1), (2), and (3) to determine if the associated plant system or structure performed a license renewal intended function. These sources were also used to develop the list of SSCs subject to an AMR.

2.1.2.3 Scoping Methodology

The IPA scoping process used by the applicant was performed in two steps, plant level scoping and system level scoping. The first step was the identification of all plant systems and structures and is described in Section 2.1.4 of the LRA. For those systems and structures determined to be in scope, a system level scoping was performed to identify the components within the systems or structures which support the system/structure intended functions. The system level scoping step as described in Section 2.1.5 of the LRA was performed to compile a list of SCs that contribute to the ability to perform the intended functions identified during the process for scoping of plant systems and structures.

2.1.2.3.1 Mechanical Systems Scoping Methodology

The process used by the applicant to identify components within mechanical systems that are within the scope of license renewal primarily relied on unique component identifiers associated with the mechanical components. These components are listed in the RAMS database. Similar to the process for the scoping of plant systems and structures, the FCS safety classification system was the method relied on for identifying components that are in scope in accordance with Criteria 1 and 2 (i.e., components that satisfy Criteria 1 and 2 are all those defined by the CQE list as being CQE or LCQE).

Scoping of system/structure components that are in scope in accordance with Criterion 3 was determined by a review of the system level scoping input documents. A detailed review of the appropriate supporting documents for FP, EQ, ATWS, and SBO was conducted for verification of SSCs credited for these events. No additional equipment was included in the scope of license renewal for the PTS rule.

The piping and instrumentation diagrams (P&IDs) contain safety classification flags for each system indicating the extent of the system that is within the scope of license renewal. A list of CQE and LCQE (and non-CQE for FP) components was extracted from the RAMS equipment database for each system the applicant determined to be in scope. Since certain components, such as piping, did not have unique identifiers in the database, additions were made to the (scoping) list and subsequently to the license renewal database (LRDB) to completely describe all of the components contributing to a particular system's ability to perform its intended functions. Some of these components were scoped as commodity groups in accordance with the guidance established in NEI 95-10 and the Standard Review Plant for License Renewal (SRP-LR).

2.1.2.3.2 Structures and Structural Component Scoping Methodology

The applicant used an evaluation boundary methodology to determine a list of structural components within each (plant level) structure that was determined to be in scope. This method was used because the majority of structural components were not identified in RAMS. The primary FCS inputs used to develop these lists were the USAR, the CQE list, DBDs, and civil and architectural drawings. The Calvert Cliffs and Oconee methodologies were also consulted to identify generic lists of structural components that have been accepted by the NRC. The lists were supplemented by plant drawings and/or written descriptions, as deemed necessary by the applicant to clearly indicate all structural components contributing to the structure's functions. As each list of structural components was produced, a determination was made whether they support the structure's ability to perform an intended function. If a structural component supported the structure's ability to perform any one of the intended functions, the structural component was automatically included within scope. Only if it could be shown that the structural component did not support the structure's ability to perform any of the intended functions was the component listed as out of scope. In those cases, an explanation of the basis for the out-of-scope determination was provided.

2.1.2.3.3 Electrical and Instrumentation and Control (I&C) Systems Scoping Methodology

The applicant used the same method to identify electrical and I&C systems in scope as for mechanical systems described above. A list of CQE and LCQE components was extracted from RAMS for each system determined to be in scope. Since certain components did not have unique identifiers in the database, additions were made to the list, as necessary, to clearly indicate the extent of the system which was identified as within scope. These types of electrical components included: alarms, analyzers, breakers, solenoid operators, switches, resistance temperature detectors (RTDs), transducers, motors, heat tracing, recorders, relays, and panels. Some of these components (e.g., cables and electrical penetration assemblies) were scoped as commodity groups. Commodity group scoping involved the use of the Fort Calhoun Automatic Cable Tracking System (FACTS). FACTS is a CQE-controlled database that is maintained separately from RAMS.

2.1.2.3.4 Commodity Groups Scoping Methodology

The applicant used commodity groups as a method to evaluate certain components which share similar materials, perform the same intended functions, and operate under similar environmental conditions for many systems. The applicant reviewed all component types to determine what could be evaluated as commodities. Commodity groups were then assembled from information on components available in the RAMS and FACTS databases. The resultant commodity groups were then entered into the LRDB for further evaluation.

The applicant developed the following commodities list:

- building piles
- bus bars
- cables and connectors
- components supports
- containment penetration and system interface components for non-CQE systems
- fuel handling equipment and heavy load cranes
- duct banks

2.1.2.4 Screening Methodology

Following the determination of SSCs within the scope of license renewal, the applicant implemented a process for determining which SCs would be subject to an AMR in accordance with the requirements of 10 CFR 54.21(a)(1). In Section 2.1.6, “Mechanical, Electrical, Structural and Commodity Component Screening,” of the LRA, the applicant discussed these screening activities as they related to the SCs that are within the scope of license renewal. These screening activities consisted of the identification of passive components, long-lived components, component intended functions, consumables, and component replacement based on performance or condition. The applicant relied on the guidance in Appendix B to NEI 95-10 and Chapter 2 of the SRP to develop the plant-specific listing of passive components of interest during the review.

2.1.3 Staff Evaluation

As part of the review of the applicant’s LRA, the staff evaluated the scoping and screening methodologies described in the following sections of the application:

- Section 2.1, “Scoping and Screening Methodology,” to ensure that the applicant describes a process for identifying SSCs that are within the scope of license renewal in accordance with the requirements of 10 CFR 54.4(a)(1), (a)(2), and (a)(3)

- Section 2.2 (“Plant Level Scoping Results”), Section 2.3 (“Scoping and Screening Results: Mechanical Systems”), Section 2.4 (“Scoping and Screening Results: Structures”), and Section 2.5 (“Screening Results: Electrical”), to ensure that the applicant described a process for determining structural, mechanical, and electrical components at FCS that are subject to an AMR for renewal in accordance with the requirements of 10 CFR 54.21(a)(1) and (a)(2)

In addition, the staff conducted a scoping and screening methodology audit at the FCS site from July 8-12, 2002. The focus of the audit was to ensure 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 application and the requirements of the Rule. The audit team reviewed implementation procedures and engineering reports which describe the scoping and screening methodology implemented by the applicant. In addition, the audit team conducted detailed discussions with the cognizant engineers on the implementation and control of the program, and reviewed administrative control documentation and selected design documentation used by the applicant during the scoping and screening process. The audit team further reviewed a sample of system scoping and screening results reports for the safety injection (SI), auxiliary feedwater (AFW), component cooling water (CCW), main steam (MS), and main feedwater (MFW) systems to ensure the methodology outlined in the administrative controls was appropriately implemented, and the results reports were found to be consistent with the CLB as described in the supporting design documentation.

2.1.3.1 Scoping Methodology

The audit team reviewed implementation procedures and engineering reports which describe the scoping and screening methodology implemented by the applicant. These procedures included (1) PED-GEI-66, "License Renewal Project Procedure," Revision 2; (2) PED-GEI-67, "Mechanical Scoping for License Renewal," Revision 1; (3) PED-GEI-68, "Mechanical Aging Management Review for License Renewal," Revision 1; (4) PED-GEI-69, "Structural Scoping for License Renewal," Revision 1; (5) PED-GEI-70, "Civil/Structural Aging Management Review for License Renewal," Revision 1; (6) PED-GEI-71, "Electrical Scoping for License Renewal," Revision 1; (7) PED-GEI-72, "Electrical Aging Management Review for License Renewal," Revision 2; (8) PED-GEI-73, "Time Limited Aging Analysis Review," Revision 0; and (9) PED-GEI-74, "Writers Guide for License Renewal Application and Associated Documents," Revision 2. The team found that the scoping and screening methodology instructions were consistent with Section 2.1 of the LRA and were of sufficient detail to provide the applicant's staff with concise guidance on the scoping and screening implementation process to be followed during the LRA activities. In addition to the implementing procedures, the audit team reviewed supplemental design information including DBDs, system drawings, and selected licensing documentation, which the applicant relied upon during the scoping and screening phases of the review. The team found these design documentation sources to be useful for ensuring that the initial scope of SSCs identified by the applicant was consistent with the FCS CLB.

2.1.3.1.1 Plant-Level Scoping of Systems and Structures

As part of the audit, the applicant further described the process used to incorporate plant design information into the LRA development process. The applicant referenced the PED-GEI 66-74 instruction series to describe the detailed process for developing the LRA application. To accomplish license renewal scoping, the applicant's engineering instructions incorporated the principle of identifying a traceable record of the scoping process by using existing plant documentation to identify systems and structures within the scope of the Rule. Specifically, documentation that the applicant used for the scoping reviews included the USAR, technical specifications, and documents comprising the FCS CLB as described in Section 2.1.2.2 of this SER. The applicant's engineering staff was cognizant of the requirements for, and use of, these information sources during the scoping development phase of the LRA project.

The applicant provided the audit team with a detailed description of the system DBDs and described how they were incorporated into the scoping and screening process. The DBDs were developed by the applicant to assure plant engineering had a verified source of detailed design information for plant systems and selected internal and external events and anticipated operational occurrences, such as internal and external missiles, high-energy line breaks, fire protection, and seismic criteria. The audit team reviewed a sample of the DBDs for both safety-related and non-safety-related systems to better understand the approach the applicant implemented to determine which SSCs would be initially placed in scope for license renewal. The team found the DBD documents to provide a concise, well-documented discussion of the system, including safety-related, non-safety-related, and NRC-required functions (i.e., functions which had been identified as a result of commitments to the NRC, including those for the Commission regulations identified under 10 CFR 54.4 (a)(3)). The DBDs also included brief descriptions of system operation during normal and off-normal conditions, a system modification history, and system and component design requirements. Included in each DBD was a detailed list of the sources of information which included plant-specific sources such as the USAR, technical specifications, calculations and analyses, as well as non-plant-specific sources such as industry codes and standards, NUREGs, regulatory guides, inspection and enforcement bulletins, notices, generic letters, and Commission orders. The DBD documentation is controlled and maintained in accordance with the applicant's site quality assurance program governed by the applicant's quality assurance plan. The audit team reviewed the governing procedures and administrative controls and determined that they presented adequate guidance for the preparation, control, and maintenance of the DBDs.

The applicant also provided the audit team with a detailed discussion on the development of the FCS system scoping report (EA-FC-00-136, "Plant Level Scoping for License Renewal," Revision 0). This report was developed by the applicant's engineering staff to help ensure that all SSCs in the CLB that address the requirements of 10 CFR 54.4(a)(1), 10 CFR 54.4(a)(2), and 10 CFR 54.4(a)(3) have been identified and considered for inclusion within the scope of license renewal. The scoping report encompasses all SSCs at FCS. The list of SSCs was developed from the output of the RAMS database and any additional pseudo-systems that were created to reflect system configurations for specific intended functions such as containment penetration isolation. The results of this evaluation were imported into the LRDB. Following the completion of the identification of the systems or structures included within the scope of license renewal, the applicant listed each system evaluated and provided a detailed description of the system, the system and structure intended functions which were the basis for including the system or structure into the scope, along with an indication of which specific Rule criteria the intended function of the system or structure satisfied. The audit team reviewed a sample of the final worksheets in Attachment 9.2, "10 CFR 54.4 System Scoping Results," of EA-FC-00-136 and compared the results to a sample of the design basis information used by the applicant as source documentation for the review. The team found that the applicant had adequately captured the system intended functions from those source documents and appropriately identified which 10 CFR 54.4 criteria each intended function satisfied.

2.1.3.1.2 Methodology for the Application of the Scoping Criteria in 10 CFR 54.4(a)

<u>Scoping Criteria in 10 CFR 54.4(a)(1)</u>

With respect to the information used to scope 10 CFR 54.4(a)(1) safety-related SSCs , the applicant's process described in instructions GEI-PED-66, 67, 69, and 71 requires that the plants CLB documentation (e.g., DBDs, USAR, and the RAMS database system) be searched to identify systems and structures that meet the safety-related criteria. The audit team reviewed a sample of the applicant's CQE-list components designated as safety-related (i.e., CQE components) and reviewed a sample of the LRDB search results tables to ensure that the applicant had adequately captured those components designated as CQE. The applicant designed a series of filters which enabled the LRA review engineers to sort through the equipment data system records and provide concise tables of component records on the basis of safety classification or specific intended functions of interest, such as environmental qualification and fire protection. The audit team determined that the filter process was a useful tool for the applicant in developing the initial scope of SSCs for the program.

As part of its review of the implementation and results of the applicant's scoping activities, the staff performed a license renewal scoping and screening inspection at the FCS site during the week of November 8, 2002, and an inspection of the applicant's aging management programs (AMPs) during the weeks of January 6 and January 20, 2003. The inspectors reviewed the applicant's engineering evaluations, documentation of the portions of the systems added to scope, and selected layout markup drawings, and discussed the process with the cognizant individuals responsible for the evaluations. Additionally, the NRC inspectors performed walkdowns of selected areas of the plant containing SSCs of interest. The inspection team identified one item which should be considered by the applicant for inclusion within scope based on the 10 CFR 54.4(a)(1) criterion. Inspection Open Item 50-285/02-07-02 identified unqualified safety injection tank level and pressure indicators that should be considered in the scope of license renewal. These indicators are used to ensure that assumptions are met for the mitigation of a loss-of-coolant-accident analysis. The applicant reviewed this issue and committed to include these components within scope. This was identified as Confirmatory Item 2.1.3.1.2-1.

By letter dated July 7, 2003, the applicant included the safety injection tank level and pressure indicators in scope. The applicant noted that these components were subsequently screened out as active components, resulting in no changes to the LRA. The staff finds the applicant's inclusion of the components within the scope of license renewal and the screening out of the components as active to be acceptable. Confirmatory Item 2.1.3.1.2-1 is closed.

On the basis of the staff's review of the applicant's methodology to identify safety-related SSCs within scope of the Rule, including:

1. review of the governing procedures and administrative controls related to scoping of safety-related SSCs in accordance with 10 CFR 54.4(a)(1) activities,

2. review of a sample of scoping result reports to ensure SSCs designated as safety-related were appropriately captured,

3. review of a sample of the design basis information used by the applicant to assure that the applicant had adequately captured the system intended functions, and

4. discussions with the applicant's cognizant personnel responsible for implementation of the scoping methodology,

the staff concludes that the applicant's scoping methodology to address the 10 CFR 54(a)(1) scoping requirements is adequate.

Scoping Criteria in 10 CFR 54.4(a)(2)

With respect to the scoping of the 10 CFR 54.4(a)(2) SSCs, the applicant initially relied on the RAMS database output of LCQE items. By definition, the LCQE items encompass those SSCs whose satisfactory performance is required to prevent or mitigate the consequences of failures of those SSCs or items identified as CQE. The audit team reviewed the LCQE items and verified that the applicant had adequately incorporated the results of these efforts into the scoping methodology reports. However as part of this review, the audit team determined that additional activities were required by the applicant to address the 10 CFR 54.4(a)(2) requirements.

With regard to the scoping of SSCs to meet the requirements of 10 CFR 54.4(a)(2), the audit team discussed the draft ISG on the 54.4(a)(2) issue with the applicant. The staff noted that by letters dated December 3, 2001, and March 15, 2002, respectively, the NRC issued a staff position to the NEI which described areas to be considered and options it expects applicants to use to determine what SSCs meet the 10 CFR 54.4(a)(2) criterion (i.e., all non-safety-related SSCs whose failure could prevent satisfactory accomplishment of any safety-related functions identified in paragraphs 10 CFR 54.4(a)(1)(i),(ii),(iii) of this section).

The December 3rd letter provided specific examples of operating experience which identified pipe failure events (summarized in Information Notice (IN) 2001-09, "Main Feedwater System Degradation in Safety-Related ASME Code Class 2 Piping Inside the Containment of a Pressurized Water Reactor") and the approaches the NRC considers acceptable to determine which piping systems should be included in scope based on the 54.4(a)(2) criterion.

The March 15th letter further described the staff's expectations for the evaluation of non-piping SSCs to determine which additional non-safety-related SSCs are within scope. The position states that applicants should not consider hypothetical failures, but rather should base their evaluation on the plant's CLB, engineering judgement and analyses, and relevant operating experience. The paper further describes operating experience as all documented plant-specific and industry-wide experience which 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 significant operating experience reports (SOERs), and engineering evaluations.

Consistent with the staff position described in the aforementioned letters, that audit team requested that the applicant respond to an RAI on the subject which was sent to the applicant on October 11, 2002. In that RAI, the staff asked the applicant to describe its scoping methodology implementation for the evaluation of the 10 CFR 54.4(a)(2) criterion. As part of its response, the applicant was requested to indicate the option(s) credited, list the SSCs included within scope as a result of its efforts, list those SCs for which AMRs were conducted, and for each SC, describe the AMPs, as applicable, to be credited for managing the identified aging effects (RAI 2.1-1).

By letter dated December 19, 2002 (Omaha Public Power District (OPPD) Letter No. LIC-02-0147), the applicant responded to the staff's RAI. As part of that response, the applicant provided a discussion of the methodology used to supplement the initial evaluation of plant SSCs with respect to the 10 CFR 54.4(a)(2) criteria. The applicant's supplemental effort consisted of:

- performing a review of all LRA boundary drawings including a review of those drawings extending beyond the scope of the license renewal boundaries
- reviewing completed plant level scoping and screening evaluations
- reviewing systems and their drawings for identified systems that were not within the scope of license renewal
- performing walkdowns of plant areas to identify the potential interactions
- reviewing piping plan and elevation drawings to determine the potential for interference of non-safety-related SCs with safety-related SCs in instances where the drawing was of sufficient detail to preclude the need to perform a physical plant walkdown

The applicant's review initially encompassed all seismic II/I and non-seismic II/I systems containing either steam or liquid as well as non-fluid-filled (i.e., air/gas) systems. With respect to the non-fluid-filled systems, the applicant performed a review of NRC generic communications and industry operating experience associated with non-fluid-filled systems. This review did not reveal any instances of failures due to age-related degradation of these systems which could prevent safety-related equipment from performing their intended functions. Review of FCS plant-specific operating experience associated with non-fluid-filled systems also did not identify any instances of such failures. As a result, no further SSCs were brought into scope for non-fluid-filled systems.

The remaining fluid-filled systems were all included in the supplemental review except for those systems which could not have an effect on safety-related SSCs because of their remoteness (i.e., physical separation) from such safety-related SSCs.

In addition, the applicant developed an EA (EA-FC-00-149,"10 CFR 54.4(a)(2) Scoping for License Renewal," Revision 0), to provide guidance and clarification for its reviewers to carry out the supplemental evaluation. The applicant's EA defined relevant spatial interactions (i.e., physical impact, pipe whip, jet impingement, leakage and spray), described the mitigative and preventive approaches to handling such interactions, provided a methodology for evaluating plant SSCs to identify any SSCs that might have a potential for spatial interaction, and provided an analysis and results for the plant. The results contained a list of systems having components which met the 10 CFR 54.4(a)(2) criteria. Included were systems previously within scope (e.g., AFW, MFW, component cooling water, chemical and volume control (CVCS), fire protection (FP), liquid waste (LWD), main steam, raw water (RW), reactor coolant, spent fuel pool cooling (SFPC), SI, and steam generator blowdown), as well as additional systems added to scope: auxiliary steam, condensate return, chemical feed, demineralized water, primary sampling, potable water, and service water.

For those SSCs within scope, the applicant performed an operating experience review to determine what plausible aging effects required managing and concluded that four programs (flow-accelerated corrosion (FAC), chemistry, general corrosion of external surfaces, and structural monitoring (SMP)) were applicable for these SSCs.

As part of its review of the implementation and results of these activities, the staff performed a license renewal scoping and screening inspection at the FCS site during the week of November 8, 2002, and an inspection of the applicant's aging management programs (AMPs) during the weeks of January 6 and January 20, 2003. The inspectors reviewed the applicant's engineering evaluation, documentation of the portions of the systems added to scope, and selected layout markup drawings, and discussed the process with the cognizant individuals responsible for the evaluations. Additionally, the NRC inspectors performed walkdowns of selected areas of the plant containing SSCs of interest. The inspection team determined that the applicant's implementation of the supplementary evaluation was comprehensive. However, the inspection team identified two items which the applicant had eliminated from the scope of license renewal which the inspection team believed should be reconsidered by the applicant for inclusion within scope based on the 10 CFR 54.4(a)(2) criterion; (1) the safety injection leakage cooler in the CCW system (Inspection Open Item 50-285/02-07-01) and (2) the warm water recirculation path to the intake structure (Inspection Open Item 50-285/02-07-04). With regard to Inspection Open Item 50-285/02-07-01, the applicant reviewed the issue and committed to include these components within the scope of license renewal. The resolution of this inspection open item can be found in NRC Inspection Report 50-285/03-07, dated March 20, 2003, and the staff's evaluation can be found in Section 2.3.3.16 of this SER. With regard to Inspection Open Item 50-285/02-07-04, during the colder winter months, a portion of the heated water in the circulating water discharge tunnel is directed to a release point upstream of the intake screens to warm the river water entering the intake structure. The purpose of this recirculation flow path is to prevent the formation of frazil ice, which can block raw water flow to the heat exchangers that help maintain adequate cooling for safety-related components. Currently, the applicant considers the systems, structures, and components supporting warm water recirculation not to be within the scope of license renewal. However, the staff found documents supporting the inclusion of this function within the scope of license renewal. After discussions with the applicant, the staff determined that the warm water recirculation issue is a 10 CFR Part 50 issue, in that the issue is relevant for the current operating term and not unique to license renewal. Therefore, the issue has been referred to the operating reactors staff for followup. The staff's evaluation can be found in Section 2.3.3.15 of this SER.

The staff has reviewed the applicant's supplemental evaluation and finds it to be acceptable on the basis of the applicant's inclusion of additional non-safety-related SSCs which meet the 10 CFR Part 54.4(a)(2) requirements using the revised methodology. As a result of this supplemental review, the applicant brought portions of additional non-safety-related systems and associated components into the scope of license renewal, supplied the results of the associated AMRs, and presented a summary of the programs and activities that will be used to manage aging of these SCs. The staff's review of the applicant's scoping results and aging management evaluation of SCs in these systems is presented in Sections 2.3.3.16 and 3.3.2.4.16 of this SER, respectively. The additional information supplied by the applicant, includes the following:

– expansion of the systems within the scope of license renewal and addition of new portions of systems within scope as a result of the revised methodology

– determination of the credible failures which could impact the ability of safety-related SSCs from performing their intended functions

– evaluation of relevant operating experience

– incorporation of identified non-safety-related SSCs into the applicant's AMPs

As a result of staff inspection and audit activities, the staff concludes that the applicant's scoping methodology to address the 10 CFR 54.4(a)(2) scoping requirements is adequate. Therefore, RAI 2.1-1 is considered resolved.

<u>Scoping Criteria in 10 CFR 54.4(a)(3)</u>

The applicant's 10 CFR 54.4(a)(3) scoping process requires identification of source documents used to provide evaluations for demonstrating compliance with each of the regulated events of interest in accordance with the regulations. The applicant's evaluations focused on identifying and verifying that specific systems or structures were relied upon in response to the particular regulated event. Specific documents that the applicant reviewed for evaluating the regulated events included (1) 10 CFR 50.48-RAMS database, USAR, DBDs, docketed correspondence to regulatory commitments to NRC that address fire protection regulations; (2) 10 CFR 50.49-Environmental Qualification List contained in the Plant EQ Manual; (3) 10 CFR 50.61-the an evaluation performed by the applicant in accordance with RG-1.154 to verify SSCs meeting the PTS Criteria; and (4) 10 CFR 50.62-docketed correspondence to regulatory commitments on ATWS and the USAR (the applicant developed an engineering analysis containing information related to the final design package for plant modifications to address the Rule); (5) 10 CFR 50.63-the applicant developed an engineering analysis containing information related to the plant calculations and analyses to address the rule. During the audit, the team reviewed a sample of the analyses and documentation to support these reviews to determine whether they provided sufficient information to allow the applicant to identify the intended functions to ensure compliance with each regulated event, and whether the applicant had identified the SSCs needed to ensure that the intended functions would be maintained. The team discussed the methodology and results with the applicant's personnel responsible for these evaluations, and verified that the applicant had identified and used pertinent engineering and licensing information in order to determine the SSCs required to be in scope within accordance with the 10 CFR 54.4(a)(3) criteria.

On the basis of the staff's review of the applicant's methodology to identify SSCs within the scope of the Rule in accordance with 10 CFR 54.4(a)(3), including:

1. review of the governing procedures and administrative controls related to scoping of safety-related SSCs in accordance with 10 CFR 54.4(a)(3) activities,

2. review of a sample of scoping result reports to ensure SSCs designated as credited for mitigation of the events defined in 10 CFR 54.4(a)(3) were appropriately captured,

3. review of a sample of the design basis information used by the applicant to assure that the applicant had adequately captured the SSC intended functions with respect to these regulated events, and

4. discussions with the applicant's cognizant personnel responsible for implementation of the scoping methodology,

and as a result of NRC inspection and audit activities, the staff concludes that the applicant's scoping methodology to address the 10 CFR 54.4(a)(3) scoping requirements is adequate.

2.1.3.1.3 Methodology for Component-Level Scoping

The applicant considered three types of classifications during component scoping: mechanical, civil and structural, and electrical. The scoping methodology for each of these component classifications is discussed below.

2.1.3.1.3.1 Mechanical Component Scoping

The methodology used by the applicant to identify mechanical system components in scope was based on initially establishing evaluation boundaries for each system. This activity was governed by PED-GEI-67. For mechanical systems, these evaluation boundaries were determined by mapping the pressure boundary associated with license renewal system intended functions onto the P&IDs. These boundary determinations included CQE, LCQE, non-CQE, and interfacing system pressure boundaries such as branch lines and instrument lines for completeness. The system components that are within the scope of license renewal (i.e., required to perform a license renewal system intended function) are then identified. This component list was incorporated into the LRDB and subsequently factored into the development of the engineering analyses which documented the scoping results for each individual system. As part of the engineering analysis process, any components which were evaluated and functionally realigned to other systems based on system intended functions were reviewed and identified in the engineering analyses. The engineering analyses listed each component from the donor system, by component type and description, as well as the system to which the component was moved.

The audit team reviewed a sample of the mechanical system P&IDs and mechanical system scoping EAs developed for the MFW, MS, SI, CCW, and AFW systems to verify that the applicant had adequately defined the scope of these systems in accordance with the methodology prescribed in PED-GEI-67. The team determined that the applicant had adequately identified those components within the selected systems in accordance with the criteria established and had provided adequate documentation to support identification of those individual system components that were functionally realigned to other systems. The team did identify a minor exception related to the auxiliary feedwater evaluation. Specifically, the P&ID for the AFW system included some piping and components downstream from the diesel-driven AFW pump as within the scope of 10 CFR 54.4. In addition, the LRDB conservatively placed the diesel-driven AFW pump fuel oil day tank as within the scope of license renewal. The tank was also checked off as subject to AMR. After further evaluation, the applicant determined that the diesel-driven AFW pump and piping was a non-safety-related portion of the AFW system that was not included in the license renewal engineering evaluation for the system. The applicant installed the diesel-driven AFW pump and associated piping in 1994 because the probabilistic risk assessment (PRA) identified a need to increase the reliability of the AFW system; however, this portion of the system was classified as non-safety-related. Based on the criteria for license renewal scope under 10 CFR 54.4, this portion of the system is not within the scope of license renewal. The audit team concluded that the applicant needed to update its

AFW drawing and the LRDB so that these documents agree with the license renewal scoping results for AFW components that are subject to an AMR. During the audit, the applicant responded to the item by initiating a condition report to correct the documentation. The team was satisfied with the applicant's actions. The audit team did not identify any additional discrepancies between the methodology documented and the implementation results.

As a result of staff's inspection and audit activities, the staff concludes that the applicant's scoping methodology to address scoping of mechanical components meets the requirements of 10 CFR 54.4(a).

2.1.3.1.3.2 Structural Component Scoping

The applicant performed its structural scoping in accordance with the detailed methodology defined in PED-GEI-69. For civil structures, the evaluation boundaries were determined by developing a complete description of each structure. This was accomplished by a review of design drawings, DBDs, the structure component list from the RAMS database, and selected plant walkdowns. PED-GEI-69 described the source design documentation to be used for the evaluation of structures meeting the criteria in 10 CFR 54.4(a)(1-3). The applicant initially identified all components within those structures and assigned component intended functions to each. These intended functions were defined as those functions the component must perform in order for the structure to be able to perform the structure intended function(s). For each structure within scope, the applicant (1) documented a list of the structural components within the evaluation boundaries for the structure, (2) identified the component intended function(s) for the structural components, and (3) identified the applicable design or licensing basis references used to make the determinations.

Design features and associated SCs that prevent potential seismic and other interactions for in-scope structures housing both safety-related and non-safety-related systems were also identified through the review of plant-specific analyses and design information related to internal and external events. Like the mechanical SCs, the structural component intended functions for in-scope SCs were identified based on the guidance provided in NEI 95-10.

The audit team reviewed PED-GEI-69, discussed the structural scoping methodology with the applicant's cognizant engineers, reviewed several plant structural drawings, and sampled several EAs to verify proper implementation of the scoping process for structural components. The team also compared a sample of structural components identified in the RAMS database to the structural list in the LRDB to ensure consistency. Based on these audit activities, the team did not identify any discrepancies between the documented methodology and the implementation results.

As a result of its inspection and audit activities, the staff concludes that the applicant's scoping methodology to address scoping of structural components meets the requirements of 10 CFR 54.4(a).

2.1.3.1.3.3 Electrical and I&C Component Scoping

The applicant performed its electrical/I&C scoping in accordance with the detailed methodology defined in PED-GEI-71. The audit team reviewed PED-GEI-71, discussed the electrical scoping methodology with the applicant's cognizant engineers, and sampled several EAs to verify proper implementation of the scoping process for electrical/I&C components. The team also reviewed the list of CQE and LCQE electrical components that were extracted from the RAMS database for each system used to create the list of components in the LRDB. The information in the RAMS and FACTS databases was used to create the license renewal database for the electrical SSCs.

The audit team found that the applicant evaluated the following electrical/I&C systems that were determined to be within the scope of license renewal, in accordance with 10 CFR 54.4: cables and connections, containment electrical penetrations, engineered safeguards, nuclear instrumentation, reactor protection system, 4160 volt alternating current (VAC), 480 VAC, 125 volt direct current (VDC), 120 VAC, plant computer, qualified safety parameter display system, radiation monitors, auxiliary instrumentation, control boards, DSS, communications, emergency lighting, and bus bars.

In PED-GEI-71, Attachment 1, the applicant evaluated the following electrical components for license renewal scope: alarm units, annunciators, cables and connections, buses, chargers, converters, invertors, circuit breakers, electrical controls and panels-internal, electrical penetration assemblies, elements, resistance temperature detectors (RTDs), sensors, thermocouples, and transducers, generators, motors, heat tracing, heaters, fuses, insulators, isolators, light bulbs, loop controllers, meters, power supplies, radiation monitors, recorders, voltage regulators, relays, signal conditioners, solenoid operators, solid state devices, surge arresters, and switches. In addition, each of these components was further subdivided into component types. For example, switches may include a differential pressure switch, flow switch, temperature indicating switch, level indicating switch, vibration switch, control switch, manual transfer switch, current switch, knife switch, etc. The intended function of a switch is to open, close, or change the connections of an electrical circuit. Some electrical components are grouped into commodity component types so that EAs could identify similar passive and long-lived intended functions and their specific failure modes.

The audit team reviewed a sampling of electrical and I&C system scoping results and determined that for the items reviewed, the scoping results appeared to be adequate. Additionally, the team did not identify any discrepancies between the documented methodology and the implementation results. Therefore, the audit team determined that the applicant's electrical and I&C scoping methodology was adequate for the identification of equipment within the scope of license renewal.

As a result of its inspection and audit activities, the staff concludes that the applicant's scoping methodology to address scoping of electrical components meets the requirements of 10 CFR 54.4(a).

2.1.3.1.3.4 Conclusion

On the basis of the staff's review of the applicant's methodology to identify mechanical, structural, and electrical components within the scope of the Rule, in accordance with 10 CFR 54.4, including:

1. review of the applicant's governing procedures and administrative controls related to scoping of mechanical, structural, and electrical SCs,

2. review of a sample of scoping result reports to ensure mechanical, structural, and electrical SCs were appropriately identified, and the scoping rationale documented,

3. review of a sample of the design basis information used by the applicant to assure that the applicant had adequately captured the mechanical, structural, and electrical component intended functions,

4. review of the license renewal database to ensure the applicant had adequately captured the mechanical, structural, and electrical components of interest in the scoping result documentation, and

5. discussions with the applicant's cognizant personnel responsible for implementation of the scoping methodology,

and as a result of NRC inspection and audit activities, the staff concludes that the applicant's mechanical, structural, and electrical component scoping methodology is adequate.

2.1.3.2 Screening Methodology

2.1.3.2.1 Evaluation of the Methodology for Identifying Structures and Components Subject to an Aging Management Review

The audit team reviewed the methodology used by the applicant to identify mechanical, structural, and electrical components within the scope of license renewal that would be subject to further aging management evaluation. The applicant provided the staff with a detailed discussion of the processes used for each discipline and provided technical reports that described the screening methodology as well as a sample of the engineering analyses for a selected group of safety-related and non-safety-related systems.

2.1.3.2.1.1 Mechanical Component Screening

During the audit of the applicant's license renewal scoping and screening process, the audit team reviewed the methodology used by the applicant to identify and list the mechanical components subject to an AMR, as well as the applicant's technical justification for this methodology. The team also examined the applicant's results from the implementation of this methodology by reviewing a sample of the mechanical systems identified as being within the scope, the evaluation boundaries drawn within those systems on the P&IDs, the resulting components determined to be within the scope of the rule, the corresponding component-level intended functions, and the resulting list of mechanical components subject to an AMR.

The applicant referenced PED-GEI-67 during the review of the screening process. This procedure was used to establish the applicant's screening methodology requirements and to establish requirements for developing EAs containing the screening results. These engineering analyses contain the record of the applicant's screening efforts to meet 10 CFR 54.37(a). Initially, the system's intended functions, in conjunction with component information in the RAMS database, pertinent design information related to the 10 CFR 54.4(a)(1-3) evaluations, and the applicable system drawings, were used to identify the passive components within the scope of license renewal. Screening criteria applied to this effort included identifying passive components in accordance with the Rule and industry guidance, as appropriate. Specifically, the in-scope SCs that perform an intended function without moving parts or without a change in configuration or properties (i.e., screening criterion of 10 CFR 54.21(a)(1)(i)) were identified. These active/passive screening determinations are based on the guidance in Appendix B to NEI 95-10. The passive, in-scope SCs that are not subject to replacement based on a qualified life or specified time period (i.e., screening criterion of 10 CFR 54.21(a)(1)(ii)) were identified as requiring an AMR. The determinations of whether passive, in-scope SCs have a qualified life or specified replacement time period were based on the review of plant-specific information, including the RAMS component database, maintenance programs and procedures, vendor manuals, and plant experience. The in-scope SCs identified as requiring an AMR were then compared to the NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," dated July 2001, to ensure that differences are valid and justified. The methodology for identifying mechanical components within the scope of the Rule included both uniquely identified (i.e., components identified in the applicant's electronic component database) and non-uniquely identified components. For the uniquely identified components, the individual components were identified and reviewed. For the non-uniquely identified components, the components were categorized by component groups or commodities. These component groups were then evaluated as part of the system screening table development.

The audit team reviewed a sample of the mechanical system EAs and discussed the process and results with the cognizant engineers who performed the review. The audit team did not identify any discrepancies between the documented methodology and the implementation results.

As a result of staff's inspection and audit activities, the staff concludes that the applicant's screening methodology to address screening of mechanical components meets the requirements of 10 CFR 54.21(a)(2).

2.1.3.2.1.2 Structural Component Screening

During the audit of the applicant's license renewal scoping and screening process, the audit team reviewed the methodology used by the applicant to identify and list the structural components and structural commodities subject to an AMR, as well as the applicant's technical justification for this methodology. The team discussed the methodology and results with the applicant's cognizant engineers. The team also examined the applicant's results from the implementation of this methodology by reviewing a sample of the plant structures (auxiliary building and turbine building) identified as being within the scope, including the evaluation boundaries and resultant components determined to be within the scope, the corresponding component-level intended functions, and the resulting list of structural components and structural commodity groups subject to an AMR.

The applicant referenced PED-GEI-69 during the review of the structural component and structural commodity screening process. This procedure was used to establish the applicant's screening methodology requirements and to establish requirements for developing EAs containing the screening results. These EAs contain the record of the applicant's screening efforts to meet 10 CFR 54.37(a). Initially, the applicant identified pertinent design information and applicable structural drawings to identify the passive structural components within the scope of license renewal. Specifically, the applicant determined that all structural components and structural commodities, with the exception of snubbers, were considered long-lived and passive and therefore subject to an AMR. The in-scope SCs identified as requiring an AMR were then compared to the GALL Report to ensure that differences are valid and justified. The methodology for identifying structural components within the scope of the Rule included both uniquely identified (i.e., components identified in the applicant's electronic component database) and non-uniquely identified components. For the uniquely identified components, the individual components were identified and reviewed. For the non-uniquely identified components, the components were categorized by component groups or commodities. These component groups were then evaluated as part of the system screening table development.

The audit team reviewed a sample of the structural drawing packages assembled by the applicant and discussed the process and results with the cognizant engineers who performed the review. The audit team did not identify any discrepancies between the documented methodology and the implementation results.

As a result of staff's inspection and audit activities, the staff concludes that the applicant's screening methodology to address screening of structural components meets the requirements of 10 CFR 54.21(a)(2).

2.1.3.2.1.3 Electrical and I&C Component Screening

During the audit of the applicant's license renewal scoping and screening process, the audit team reviewed the methodology used by the applicant to identify and list the electrical components and electrical commodities subject to an AMR, as well as the applicant's technical justification for this methodology. The team discussed the methodology and results with the applicant's cognizant engineers. The team also sampled several EAs to verify proper implementation of the screening process for electrical/I&C components.

The applicant referenced PED-GEI-71 during the review of the electrical components and electrical commodities screening process. This procedure was used to establish the applicant's screening methodology requirements and to establish requirements for developing EAs containing the screening results. The screening results reports provided a description for each of the electrical/I&C component groups identified by the applicant during its review. The passive functions for each electrical/I&C component are also identified, along with the AMP information credited for the electrical components and electrical commodities. The applicant used a commodity evaluation approach based on a plant-level evaluation of electrical/I&C systems and components. After identifying the SSCs within the scope of license renewal, the applicant performed the following screening review to determine which electrical components would be subject to an AMR. As part of this effort, the applicant relied on the requirements stated in 10 CFR 54.21(a)(1)(i), as supplemented by industry guidance in NEI 95-10, to develop a commodity evaluation approach. The majority of electrical/I&C component groups (such as transmitters, switches, breakers, relays, actuators, radiation monitors, recorders, isolators, signal conditioners, meters, batteries, analyzers, chargers, motors, regulators, transformers, and fuses) are considered active, in accordance with 10 CFR 54.21(a)(1)(i) and the supplemental guidance in NEI 95-10, and therefore do not require an AMR. For the passive electrical/I&C component commodity groups, component commodity groups that are not subject to replacement based on a qualified life or specified time period (screening criterion of 10 CFR 54.21(a)(1)(ii)) were identified as requiring an AMR. Electrical/I&C component commodity groups covered by the FCS 10 CFR 50.49, "Environmental Qualification Program," were considered to be subject to replacement based on qualified life. Certain passive, long-lived electrical/I&C component commodity groups that do not support license renewal system intended functions were eliminated. The in-scope SCs identified as requiring an AMR were compared to the GALL Report to ensure differences are valid and justified. The audit team determined that the methodology used in PED-GEI-71 was adequate for identifying passive and long-lived electrical components that are subject to an AMR. The audit team did not identify any discrepancies between the documented methodology and the implementation results.

As a result of staff's inspection and audit activities, the staff concludes that the applicant's screening methodology to address screening of electrical and I&C components meets the requirements of 10 CFR 54.21(a)(2).

2.1.3.2.1.4 Conclusion

On the basis of the staff's review of the applicant's methodology to identify mechanical, structural, and electrical components subject to an aging management review in accordance with 10 CFR 54.21, including:

1. review of the applicant's governing procedures and administrative controls related to screening of mechanical, structural, and electrical SCs,

2. review of a sample of screening result reports to ensure mechanical, structural, and electrical SCs were appropriately identified, and the screening rationale documented,

3. review of a sample of the design basis information used by the applicant to assure that the applicant had adequately captured the mechanical, structural, and electrical component intended functions (i.e., passive functions),

4. review of the license renewal database to ensure the applicant had adequately captured the mechanical, structural, and electrical components of interest and identified relevant commodity groups for non uniquely-identified components in the screening result documentation , and

5. discussions with the applicant's cognizant personnel responsible for implementation of the screening methodology,

and as a result of NRC inspection and audit activities, the staff concludes that the applicant's mechanical, structural, and electrical component screening methodology is adequate.

2.1.4 Evaluation Findings

The staff review of the information presented in Section 2.1 of the LRA, the supporting information in the FCS USAR, the information presented during the scoping and screening audit, the NRC scoping and aging management review inspections, and the applicant's responses to the staff's RAIs, formed the basis of the staff's safety determination. The staff verified that the applicant's scoping and screening methodology, including its supplemental 10 CFR 54.4(a)(2) review, which brought additional non-safety-related piping segments and associated components into the scope of license renewal was adequate to meet the requirements of the Rule. On the basis of this review, the staff concludes that the applicant's methodology for identifying the systems, structures, and components within the scope of

license renewal and the structures and components requiring an aging management review satisfies the requirements of 10 CFR 54.4 and
10 CFR 54.21(a)(1).

2.2 Plant-Level Scoping Results

2.2.1 Summary of Technical Information in the Application

This section addresses the plant-level scoping results for license renewal. 10 CFR 54.21(a)(1) requires the applicant to identify and list structures and components subject to an AMR. These are passive and long-lived SCs that are within the scope of license renewal.

In LRA Table 2.2-1, the applicant provided a list of the plant systems and structures, identifying those that are within the scope of license renewal. The Rule does not require the identification of all plant systems and structures. However, providing such a list allows for a more efficient staff review. On the basis of the DBEs considered in the plant's CLB, and other CLB information relating to non-safety-related systems and structures, and certain regulated events, the applicant identified those plant-level systems and structures within the scope of license renewal, as defined in 10 CFR 54.4(a). To verify that the applicant has properly implemented its methodology, the staff focused its review on the implementation results to confirm that there is no omission of plant-level systems and structures within the scope of license renewal.

2.2.2 Staff Evaluation

In LRA Section 2.1, the applicant describes its methodology for identifying the SCs that are within the scope of license renewal and subject to an AMR. This methodology typically consists of a review of all plant SSCs to identify those that are within the scope of license renewal in accordance with the requirements of 10 CFR 54.4. From those SSCs that are within the scope of license renewal, an applicant will identify and list those SCs that are passive (i.e., that perform their intended function(s) without moving parts, or without a change in configuration or properties) and are long-lived (i.e., that are not replaced based on a qualified life or specified time period). The staff reviewed the scoping methodology and provided its evaluation in Section 2.1 of this SER. The applicant documented the implementation of the methodology in LRA Sections 2.3 through 2.5. The staff's review of the applicant's implementation can be found in Sections 2.3 through 2.5 of this SER.

To ensure that the scoping methodology described in LRA Section 2.1 was properly implemented, and that the SCs that are subject to an AMR were properly identified, the staff performed an additional review. The staff sampled the contents of the USAR based on the listing of systems and structures in LRA Table 2.2-1 to determine whether there were systems or structures that may have intended functions as defined by 10 CFR 54.4 but were not included within the scope of license renewal.

During its review, the staff determined that additional information and/or clarification was needed to complete its review. By letter dated October 11, 2002, the staff issued RAIs 2.2-1, 2.2-2, and 2.2-3 to obtain the necessary information and clarification from the applicant in the following areas:

- A legend was not provided for the system drawings. A legend is needed to ensure the staff can properly identify system components. In a letter dated December 19, 2002, the applicant provided a legend.

- For some of the systems highlighted on the system drawings, the license renewal boundaries appear to start/stop at the boundary between two design classes. The staff requested definitions of the design classes used at FCS and clarification on which design classes contain critical quality element (CQE) components and limited CQE (LCQE) components. In a letter dated December 19, 2002, the applicant provided the requested information.

The staff determined that the applicant's responses were acceptable because they provided the information needed by the staff to complete its review.

By letter dated October 11, 2002, the staff issued RAI 2.1.4-1 to request that the applicant identify which SSCs are credited for meeting the requirements of 10 CFR 54.4(a)(3) for 10 CFR 50.61, "Pressurized Thermal Shock," and 10 CFR 50.62, "Anticipated Transient Without Scram." In a letter dated December 19, 2002, the applicant identified the design and installation of the diverse scram system (DSS) as meeting the requirements found in 10 CFR 50.62(c)(1) and (2). As described in USAR Section 7.2.11, the DSS provides an independent means of initiating a reactor trip as required by 10 CFR 50.62(c)(1). USAR Section 7.2.11 does not identify that the DSS performs the functions required by 10 CFR 50.62(c)(1). By letter dated February 20, 2003, the staff issued Potential Open Item (POI)-1(b), requesting the applicant to address its compliance with 10 CFR 50.62(c)(1). By letter dated March 14, 2003, the applicant responded to POI-1(b) by stating that the DSS performs the turbine trip function required by 10 CFR 50.62(c)(1). The DSS design description states that the DSS provides an inherent diverse turbine trip. When the DSS causes a reactor trip, it also causes the turbine to trip because the DSS interrupts power to the control element assembly (CEA) coils. The turbine trip is then initiated when clutch power supply relays are deenergized. When power is interrupted to the coils, the undervoltage relays on the clutch power supplies are deenergized and a turbine trip is initiated. With the implementation of the DSS, the existing turbine trip becomes a diverse turbine trip due to the diversity between the DSS and the existing reactor trip system. The clutch power relays of the reactor protection system (RPS) are the "final actuation device," as specified in 10 CFR 50.62(c)(1).

The DSS also fulfills the requirements of 10 CFR 50.62(c)(2) by providing an independent means to initiate a reactor trip, as described in USAR Section 7.2.11.1.

The AFW system is not initiated by the DSS or the RPS. The AFW system is stand-alone, in that its initiation devices are completely diverse from the RPS. Therefore, the AFW system also meets the intent of 10 CFR 50.62(c)(1). The DSS, RPS, and AFW system meet the requirements of 10 CFR 50.62(c)(1) and (2) and are within the scope of license renewal. Their SSCs have been screened per NEI 95-10, Revision 3.

The staff reviewed the applicant's response to POI-1(b) and finds it acceptable because the response adequately addresses compliance with 10 CFR 50.62(c)(1). POI-1(b) is resolved.

In the same letter, the applicant identified the reactor vessel beltline plates and welds as the only SSCs included within the scope of license renewal for PTS. On the basis of its review of the applicant’s response, the staff determined that the PTS portion of the response was acceptable because it identified the components that the applicant believed to be required for compliance with the PTS Rule.

The staff also determined that additional information was needed to complete its review based on information provided by the applicant during the AMR inspection. During the AMR inspection and audit, the team reviewed the onsite engineering analysis (EA)-FC-00-149, “NSR Steam and Water Systems Impacting SSC Within Scope For License Renewal.” In this EA, the applicant identified piping systems and associated reference drawings for those systems that have met the 10 CFR 54.4(a)(2) criteria for spatial interaction. However, after discussions with the staff, the applicant indicated that some of these systems are already identified as being within the scope of license renewal but were not identified as being within scope in the LRA. The applicant also stated that the Flow-Accelerated Corrosion (FAC), Chemistry, General Corrosion of External Surfaces, and Structures Monitoring Programs are the applicable AMPs to manage aging effects for components in these systems.

On the basis of its review, the staff determined that the information, as provided by the applicant, was not sufficient for the staff’s scoping and AMRs for these 10 CFR 54.4(a)(2) SSCs. For the additional SSCs that had been brought into scope to meet the 10 CFR 54.4(a)(2) criterion, the applicant was requested to provide scoping information to the component level equivalent to that of the original LRA. This information was necessary for the staff to be able to determine that all the components required by 10 CFR 54.4(a)(2) to be within the scope of license renewal and subject to an AMR had been correctly identified. Also, the applicant was requested to provide revised and/or new Section 2 tables, including links to Section 3 tables, so that the staff could perform an AMR to determine whether the applicant had identified the proper aging effects for the combination of the materials and environments, and had provided an adequate AMP for managing the corresponding aging effects for these SSCs.

By letter dated February 20, 2003, the staff issued POI-1(a) requesting that the applicant provide the above information. By letter dated March 14, 2003, the applicant provided the requested information. The staff reviewed the information and found that the applicant had adequately identified the SSCs within the scope of license renewal as a result of meeting the 10 CFR 54.4(a)(2) scoping criterion. POI-1(a) is resolved. However, the staff still had to review the AMR results for the additional components brought into scope and subject to an AMR to determine whether they would be adequately managed during the period of extended operation. This was identified as Open Item 2.2-1.

The staff has completed its review of the aging management information provided by the applicant and has determined that the structures and components discussed above will be adequately managed during the period of extended operation. On this basis, Open Item 2.2-1 is closed.

The staff performed a complete review of SSCs at FCS and determined that no other SSCs were omitted from scope based on the 10 CFR 54.4(a)(2) criterion.

Functional Realignment

"Functional realignment" for license renewal is defined as the transfer of in-scope components from one system into another system based on a common in-scope function, common materials and environments, or alignment to the GALL Report.

The staff's review, supported by the findings of the scoping and screening inspection (see Inspection Open Item 50-285/02-07-03) found that the LRA did not clearly describe the methodology used to functionally realign components between systems. During the scoping and screening inspection, the inspection team reviewed the applicant's onsite scoping documents to determine how functional realignment was implemented for license renewal. Specifically, the team reviewed engineering analysis (EA) FC-00-127, "Miscellaneous Systems, Penetrations, and Components," to determine if the EA described the functional realignment methodology. The EA did not clearly describe the functional realignment methodology. The applicant clarified that at FCS, all mechanical and electrical components have an assigned system in which they are grouped. Most structural components such as beams, columns, floors, and walls have no component identification assigned to them. The applicant performed the scoping portion of the integrated plant assessment (IPA) in two phases. The first phase was the plant-level scoping, which evaluated all systems and structures to identify the systems and structures which performed intended functions and eliminate those which had no intended function. The second phase of the IPA was the system-level scoping, which evaluated the individual components within each system to determine the component intended function, screened in the boundary components, and performed the aging management evaluation for the components.

Component transfers occur for one of three reasons. The first reason is the use of commodity groups. Once the plant-level scoping was completed and the list of in-scope systems was compiled, the applicant identified certain commodity groups that would be used to simplify the IPA process. These commodity groups would then be populated with the matching components from the in-scope systems. Examples of components that were commoditized are cables, duct banks, component supports, bus bars, pilings, fuel-handling equipment and heavy loads cranes, and containment penetration and pressure boundary components.

Components which fell into the commodity groups identified above were transferred from the original system to the commodity group for component scoping, screening, and aging management evaluation. Because there are some systems whose only intended function was performed by the transferred components (such as containment penetration components for the service air system), those systems no longer performed an intended function and were eliminated from Phase 2 of the IPA.

Secondly, there are some components which are located at the interface between two systems. During original plant design, these components were assigned to systems based mainly on engineering judgment. During the IPA process, some of these components at the system interfaces were realigned from one system to another based on materials and environments. For example, a control valve on an instrument air line to the actuator on a safety injection valve may be classified as a safety injection valve. However, for the purposes of aging management, it is transferred to the instrument air system because the materials and environment for that component better align with instrument air.

The third reason for component transfers was for better alignment with the GALL Report. If a component type is identified in GALL as being evaluated in a different system such as the component cooling water heat exchangers being evaluated in the system generating the heat load, then it was typically transferred to the heat generating system to align with GALL.

In all cases, the functional realignment of components was strictly controlled. The engineers working on the system-level scoping analysis were prevented from realigning any components into or out of his/her system until agreement was made with the owner of the system to which, or from which, the component was being realigned. The discipline lead would then get the approval of the IPA supervisor, who would then authorize the realignment of the component in the license renewal database. On the basis of the applicant's explanation of the realignment methodology, along with its review of functionally realigned components, the inspection team concluded that in-scope components in systems which have no other in-scope functions were appropriately functionally realigned based on their common in-scope function. The applicant also committed to revising the onsite documentation to clearly describe the methodology used to realign components between systems.

The EA stated that the compressed air, demineralized water, and steam generator feedwater blowdown systems contain components that were functionally realigned. The team noted that this was inconsistent with LRA Table 2.2-1 and LRA Section 2.3.2.2. LRA Table 2.2-1 stated that containment isolation and/or pressure boundary components in the compressed air, demineralized water, and blowpipe (containment integrated leak rate test pressure penetration) systems were functionally realigned to the commodity group, "Containment Penetration and System Interface Components for Non-CQE Related System." However, LRA Section 2.3.2.2, which described this commodity group, stated that the group contains containment isolation valves (CIVs) from the feedwater blowdown, compressed air, blowpipe, and demineralized water systems, as well as the piping between the containment penetrations and the CIVs. It also stated that the demineralized water heat exchangers are included in the commodity group in order to maintain the component cooling water (CCW) system pressure boundary. LRA Table 2.2-1 and the description in LRA Section 2.3.2.2 are inconsistent in that the blowdown system was not identified in LRA Table 2.2-1 as having components that were functionally realigned. By letter dated February 20, 2003, the staff issued POI-1(d) requesting the applicant to resolve this discrepancy between LRA Table 2.2-1 and the description in LRA Section 2.3.2.2, and to provide revised Section 2 tables and, if necessary, revised Section 3 tables to accurately describe which systems and/or components have been functionally realigned and how the components will be managed.

By letter dated March 14, 2003, the applicant responded to POI-1(d), providing revisions to LRA Table 2.2-1 and LRA Section 2.3.2.2 and an additional drawing to clearly identify the blowpipe system. On the basis of the applicant's response, POI-1(d) was resolved. However, the staff still needed to review the information provided to ensure that all components within scope and subject to an AMR had been identified. This was identified as Open Item 2.2-2.

The staff has now completed its review and confirmed that no components within these systems were omitted from scope and none that are subject to an AMR were omitted. On the basis of the staff's review, as described above, Open Item 2.2-2 is closed.

2.2.3 Evaluation Findings

The staff reviewed all SSCs at FCS to determine whether any SSCs that met the 10 CFR 54.4 scoping criteria had been omitted. On the basis of its review, the staff found several systems and components that were reviewed by the applicant and identified as outside the scope of license renewal, and for which the staff disagreed. These systems and components were subsequently brought into scope. The staff reviewed the remainder of the out-of-scope SSCs and found no other omissions. On the basis of its review, including the identification of additional systems and components brought into scope, the staff concludes that all systems, structures, and components within the scope of license renewal have been identified, in accordance with the requirements of 10 CFR 54.4. The staff's evaluation of the additional SSCs brought into scope is provided as part of the resolution of Open Items 2.2-1 and 2.2-2.

2.3 Scoping and Screening Results: Mechanical Systems

This section addresses the mechanical systems' scoping and screening results for license renewal. The following mechanical systems and their corresponding SER sections are addressed.

- Reactor Systems

  Reactor Vessel Internals (2.3.1.1)
  Reactor Coolant (2.3.1.2)
  Reactor Vessel (2.3.1.3)

- Engineered Safety Feature Systems

  Safety Injection and Containment Spray (2.3.2.1)
  Containment Penetration and System Interface Components for Non-CQE Systems (2.3.2.2)

- Auxiliary Systems

  Chemical and Volume Control (2.3.3.1)
  Spent Fuel Pool Cooling (2.3.3.2)
  Emergency Diesel Generators (2.3.3.3)
  Emergency Diesel Generator Lube Oil and Fuel Oil (2.3.3.4)
  Auxiliary Boiler Fuel Oil and Fire Protection Fuel Oil (2.3.3.5)
  Emergency Diesel Generator Jacket Water (2.3.3.6)
  Starting Air (2.3.3.7)
  Instrument Air (2.3.3.8)
  Nitrogen Gas (2.3.3.9)
  Containment HVAC (2.3.3.10)
  Auxiliary Building HVAC (2.3.3.11)
  Control Room HVAC and Toxic Gas Monitoring (2.3.3.12)
  Ventilating Air (2.3.3.13)
  Fire Protection (2.3.3.14)
  Raw Water (2.3.3.15)
  Component Cooling (2.3.3.16)

Liquid Waste Disposal (2.3.3.17)
Gaseous Waste Disposal (2.3.3.18)
Primary Sampling (2.3.3.19)
Radiation Monitoring-Mechanical (2.3.3.20)

- Steam and Power Conversion Systems

  Feedwater (2.3.4.1)
  Auxiliary Feedwater (2.3.4.2)
  Main Steam and Turbine Steam Extraction (2.3.4.3)
  Steam Generator Blowdown

10 CFR 54.21(a)(1) requires an applicant to identify and list structures and components subject to an AMR. These are passive, long-lived structures and components that are within the scope of license renewal. To verify that the applicant has properly implemented its methodology, the staff focuses its review on the implementation results. Such a focus allows the staff to confirm that there is no omission of mechanical system components that are subject to an AMR.

2.3.1 Reactor Systems

In LRA Section 2.3.1, “Reactor Coolant System,” the applicant described the SSCs of the reactor coolant system (RCS) that are subject to an AMR for license renewal.

Reactor systems are those systems designed to contain and support the nuclear fuel, contain the reactor coolant, and transfer the heat produced in the reactor to the steam and power conversion systems for the production of electricity. The following systems are included in this subsection:

- reactor vessel internals (2.3.1.1)
- reactor coolant (2.3.1.2)
- reactor vessel (2.3.1.3)

2.3.1.1 Reactor Vessel Internals

2.3.1.1.1 Summary of Technical Information in the Application

The applicant describes the reactor vessel internals in LRA Section 2.3.1.1 and provides a list of components subject to an AMR in LRA Table 2.3.1.1-1.

As described in the LRA, the reactor vessel internals (RVI) were designed to support and align the fuel assemblies, control element assemblies (CEAs), and in-core instrumentation (ICI) assemblies and to guide reactor coolant through the reactor vessel. The RVI were also designed to absorb static and dynamic loads and transmit these loads to the reactor vessel flange.

The RVI were designed to safely perform their functions in normal operating, upset, and emergency conditions and to safely withstand the forces due to deadweight, handling, system pressure, flow impingement, temperature differential, shock, and vibration.

All RVI components are considered Class 1 for seismic design. The design of the RVI limits deflection where such limits are required by function. The stress values of all structural components under normal operating and expected transient conditions are not greater than those established by Section III of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code. The effects of neutron embrittlement on materials and accident loadings on the internals have been considered in the design analysis.

The license renewal boundary for the RVI consists of all components internal to the reactor vessel, excluding the reactor vessel and head, the control element drive mechanisms (CEDMs), and integral attachments to the reactor vessel and head.

The components of the RVI consist of the following major components and their associated subcomponents:

- upper guide structure (UGS)
- core support barrel (CSB)
- thermal shield
- flow skirt
- core shroud
- CEA shroud assemblies
- ICI support assemblies
- lower support structure
- CEA
- fuel assemblies

The main system interfaces for the RVI are the reactor coolant system (RCS) and the reactor vessel (RV).

RVI figures can be found in the FCS USAR Section 3, Figures 3.1-1, 3.1-2, and 3.7-1.

More information about RVI can be found in USAR Section 3.7.1.

The RVI component types subject to aging management review and their intended functions are shown in Table 2.3.1.1-1 of the LRA. The component types which were identified for the RVI include CEA shroud bolts, CSB snubber bolts, thermal shield bolts and core shroud bolts, CEA shroud spanner nuts, and ICI support, CSB bolts and lower internals assembly bolts, CEA shrouds (base, tube, and transition piece), CEA shrouds (dual shrouds), CSB, core support ring, CSB alignment key and CSB upper flange, CSB nozzle, CSB - spacer, locking collar, dowel pin and locking bar, CSB snubber spacer block, core shroud, core shroud - dowel pin, flow skirt, fuel assembly alignment plate, ICI guide tube & supports, ICI support plate & gusset, instrument tube & supports, lower internals assembly - manhole cover plate & bottom plate, lower internals assembly - core support columns, lower internals assembly - core support plate and support beams and flanges, lower internals assembly - anchor block and dowel pins, thermal shields, thermal shield support - pin & shim, UGS - ring shim, tab & plate, UGS - dowel pin, guide pin & locking strip, UGS - guide pin, UGS - alignment lug, UGS - alignment lug screw and nut, UGS - key slot tab, UGS - hold-down ring, UGS - support plate & sleeves.

The intended functions identified for the RVI components were structure functional support, flow distribution, and radiation shielding.

2.3.1.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.1 to determine whether the reactor vessel internals and supporting structures within the scope of license renewal and subject to AMR have been identified in accordance with the requirements of 10 CFR 54.4 and 10 CFR 54.21(a)(1), respectively. This was accomplished as described below.

As part of the evaluation, the staff determined whether the applicant had properly identified the systems, structures, and components within the scope of license renewal and subject to an AMR, pursuant to 10 CFR 54.4(a) and 10 CFR 54.21(a)(1). The staff reviewed the relevant portions of the USAR for the reactor vessel internals and associated pressure boundary components and compared the information in the USAR with the information in the LRA to identify those portions that the LRA did not identify as being within the scope of license renewal and subject to an AMR. The staff then reviewed the structures and components that were identified as not being within the scope of license renewal to verify that these structures and components do not have any of the intended functions delineated under 10 CFR 54.4(a), and for those structures and components that have an applicable intended function(s), to verify that they either perform this function(s) with moving parts or a change in configuration or properties, or that they are subject to replacement based on a qualified life or specified time period, as described in 10 CFR 54.21(a)(1).

The staff also reviewed the USAR for any function(s) delineated under 10 CFR 54.4(a) that were not identified as intended function(s) in the LRA, to verify that the systems, structures, and components with such function(s) will be adequately managed so that the function(s) will be maintained consistent with the CLB for the period of extended operation.

The staff did not identify any omissions.

2.3.1.1.3 Conclusions

The staff reviewed the information presented in Section 2.3.1.1 of the LRA and the supporting information in the FCS USAR to determine whether any SSCs that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On this basis, the staff concludes that the applicant has adequately identified the RVI components that are within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the RVI components that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.1.2 Reactor Coolant System

2.3.1.2.1 Summary of Technical Information in the Application

The RCS consists of two heat transfer loops connected in parallel to the reactor vessel. Each loop contains one steam generator, two reactor coolant pumps, connecting piping, and instrumentation. A pressurizer is connected to one of the reactor vessel outlet (hot leg) pipes by a surge line. The pressurizer has both power-operated relief valves (PORVs) and safety valves, which discharge to the quench tank (Class 4, non-CQE) to condense and cool valve discharges. All components of the RCS are located within the containment building.

The RCS is designed to remove heat from the reactor core and internals and transfer it to the secondary (steam generating) system by the controlled circulation of pressurized, borated water that serves both as a coolant and a neutron moderator. The RCS serves as a barrier to the release of radioactive materials to the containment building and is equipped with controls and safety features that ensure safe conditions within the system. The design pressure is 2500 psia. The design temperature is 650 °F (pressurizer - 700 °F).

The RCS pressure is maintained and controlled through the use of the pressurizer, where steam and water are maintained in thermal equilibrium. Steam is formed by energizing immersion heaters in the pressurizer or is condensed by subcooled pressurizer spray, as necessary, to maintain operating pressure and limit pressure variations due to plant load transients. Overpressure protection for the system is provided by two PORVs and two spring loaded American Society of Mechanical Engineers (ASME) Code safety valves. These valves discharge to the quench tank where the steam is released under water to be condensed and cooled. If the steam discharge exceeds the capacity of the tank, the tank is relieved to the containment atmosphere.

The RCS boundary includes all the components in the RCS except the reactor vessel and head. The main RCS components include the reactor coolant pumps and motors, reactor coolant piping, pressurizer, pressurizer heaters, PORVs and safety valves, steam generators, and associated instrumentation and controls.

The steam generator boundaries are set at the ends of the nozzles connecting the steam generators to other components or systems. The nozzles include main feedwater, auxiliary feedwater, steam, RCS inlet and outlet, and instrumentation. The nozzles and integral attachments are considered part of each steam generator.

The major system interfaces with the RCS are the CVCS, SI, RPS, reactor regulating system, the engineered safety features actuation system (ESFAS), and the reactor vessel.

GALL Report Item IV.C2.6-a, discusses the pressurizer relief tank. The analogous FCS component, the quench tank, is not within the scope of license renewal at FCS, as it has no intended function. The staff reviewed the information and agrees with the applicant’s conclusion.

The pressurizer spray head listed in GALL Report Item IV.C2.5-d, is not within the scope of license renewal at FCS, as it has no intended function. The spray head and its spray function are not credited for the mitigation of any accidents addressed in the USAR accident analyses and therefore does not meet the scoping requirements of 10 CFR 54.4(a)(1). The function of the pressurizer spray is to reduce RCS pressure under normal operating conditions. Also, its failure would not prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a)(1). On the basis of this clarification, the staff agrees with the applicant’s conclusion that the spray head need not be within the scope of license renewal.

SRP-LR Table 2.3-1, includes a pressurizer spray head with no intended functions as an example of a component not within the scope of license renewal.

More information about the RCS can be found in USAR Section 4.

The RCS component types subject to aging management review and their intended functions are shown in Table 2.3.1.2-1 of the LRA. The component types identified for the RCS include bolting, flow element / orifice, feedwater (FW) nozzle safe ends, pressurizer and SG nozzle welds, pressurizer bottom plate (cladding), pressurizer heater sleeves, pressurizer heater support assembly, pressurizer manway, pressurizer RV (relief valve) nozzle insert and pressurizer upper and lower level nozzle inserts, pressurizer RV and upper and lower level nozzles, pressurizer RV, spray, surge, SV (safety valve), and Upper and lower level nozzle welds, pressurizer RV, spray, surge, temperature, and upper and lower level nozzle safe ends, pressurizer shell and plates, pressurizer shell and top head plate (cladding), pressurizer spray and surge nozzle thermal sleeves, pressurizer spray, surge, and SV nozzles (base), pressurizer spray, surge, and SV nozzles (cladding), pressurizer support assembly, pressurizer SV nozzle flange and temperature nozzle, pressurizer temperature nozzle and SV nozzle flange, pressurizer vessel welds, pressurizer welds, primary and secondary manways / handholes, reactor coolant (RC) hot and cold leg piping, RC piping charging, drain, pressure measurement, pressure measurement and sampling, shutdown cooling (SDC) inlet and outlet, spray, and surge nozzles, RC piping charging, SDC inlet, and surge nozzle thermal sleeves, RC piping nozzle thermal sleeves, RC piping nozzles, RC piping thermowells and stainless steel welds, RC piping welds, RC vent gas system, pressurizer spray, CVCS, and PORV line piping, RC surge line piping, RCP driver mounts, RCP pump cover, RCP seal cover and bleed-off flange, RCP seal water cooler tubes, RCP pressure breakdown devices, RCP casing, SG blowdown nozzles, SG FW nozzle safe end, SG FW, primary, instrument, and steam nozzles, SG nozzle welds, SG primary head (base and cladding), SG primary manways, SG primary nozzle, SG primary nozzle safe end, SG secondary head, shell, and transition cone, SG secondary manways and handholes, SG steam nozzle safe end, SG tube plugs, SG tube sheet, SG tube supports, SG blowdown nozzles, SG tubes, and valve bodies.

The intended functions identified for the RC components were pressure boundary, fission product retention, component structural support, fatigue prevention, structure functional support, and heat transfer.

2.3.1.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.1.2 of the LRA to determine whether the RCS and associated components and supporting structures within the scope of license renewal and subject to AMR have been identified in accordance with the requirements of 10 CFR 54.4 and 10 CFR 54.21(a)(1), respectively. This was accomplished as described below.

As part of the evaluation, the staff determined whether the applicant had properly identified the systems, structures, and components within the scope of license renewal and subject to an AMR, pursuant to 10 CFR 54.4(a) and 10 CFR 54.21(a)(1). The staff reviewed the relevant portions of the USAR for FCS for the RCS and associated components and compared the information in the USAR with the information in the LRA to identify those portions that the LRA did not identify as being within the scope of license renewal and subject to an AMR. The staff then reviewed the structures and components that were identified as not being within the scope of license renewal to verify that these structures and components do not have any of the intended functions delineated under 10 CFR 54.4(a), and for those structures and components that have an applicable intended function(s), to verify that they either perform this function(s) with moving parts or a change in configuration or properties, or that they are subject to replacement based on a qualified life or specified time period, as described in 10 CFR 54.21(a)(1).

The staff also reviewed the USAR for any function(s) delineated under 10 CFR 54.4(a) that were not identified as intended function(s) in the LRA, to verify that the systems, structures, and components with such function(s) will be adequately managed so that the function(s) will be maintained consistent with the CLB for the period of extended operation.

After completing the initial review, the staff requested the applicant to provide additional information on the RCS. By letter dated December 19, 2002, the applicant responded to the staff's request for additional information (RAI) as discussed below.

The FCS CLB for fire protection (FP) complies with certain sections of Appendix R, particularly Section III.G, which provides the requirements for the fire protection safe shutdown capability. In RAI 2.3.1.2-1, the staff requested the applicant to discuss if the pressurizer spray head and associated piping are credited and relied upon in the fire protection safe shutdown analysis to bring the plant to cold shutdown conditions within a given time for compliance with Appendix R. If it is credited in the fire protection safe shutdown analysis, the pressurizer spray head and associated piping would satisfy 10 CFR 50.48 Appendix R requirements and, therefore, should be included within the scope of license renewal. The specific intended function of the subject components which meets the 10 CFR 54.4(a)(3) requirement is the spray function, and the particular components which help perform this function are the section of piping and the spray head located inside the pressurizer. The subject components do not have a pressure boundary function. The staff believed that with the loss of spray function, it may not be possible to bring the plant to cold shutdown conditions in a timeframe that complies with Appendix R and, therefore, the spray head and associated piping inside the pressurizer and the spray function should be identified as within the scope of license renewal. Furthermore, the staff believed that the applicant should propose an AMP for the spray head and associated piping inside the pressurizer, which would ensure that adequate spray function will be maintained during the period of extended operation. In response, the applicant stated that, on the basis of its analysis, the spray nozzle pattern is not credited for the pressure reduction that is accomplished during spray function activation, should it be necessary to bring the plant to cold shutdown conditions within the allowable time for compliance with Appendix R. It is stated that the analysis only takes credit for the volume of water added to the pressurizer steam bubble through the spray nozzle, and that the generation of a spray pattern by the spray nozzle is not, therefore, a license renewal intended function.

As part of this RAI response, the applicant further added that the pressurizer spray is one of three means available for RCS pressure reduction and subsequent cooldown. In the event of a fire followed by a reactor trip, the auxiliary spray system (which uses the pressurizer spray head supplied by CVCS) or the PORVs may be used to depressurize the RCS. In the event that these two methods are unavailable, primary system depressurization is accomplished by RCS charging and sufficient secondary decay heat removal via the steam generator safety valves and auxiliary feedwater system. The SSCs associated with this depressurization method are within the scope of license renewal, and those that are passive and long-lived are subject to an AMR.

The staff finds the applicant's response to RAI 2.3.1.2-1 acceptable on the basis that, in spite of reduced efficiency of the pressurizer with an aged and degraded spray head, FCS can still comply with the Appendix R requirements. Thus, the pressurizer spray head and associated piping are not within the scope of license renewal.

Pursuant to 10 CFR Part 50, Appendix R, Section III.O, the RCP lube oil collection subsystem is designed to collect oil from the RCPs and drain it to a collection tank to prevent a fire in the containment building during normal plant operations. The staff believes that the subsystem and the tank should be within the scope of license renewal and require aging management. However, it appears that the subject components were not identified in the LRA (Tables 2.3.1.2-1 or 2.3.3.14-1); therefore, in RAI 2.3.1.2-2, the staff requested the applicant to provide an explanation. In response, the applicant stated that the RCP lube oil collection subsystem is included within the scope of license renewal and addressed in Table 2.3.3.14-1, "Fire Protection," under the component types "Pipes & Fittings, Piping Spray Shield," and "Pressure Vessels." The applicable components are linked to AMR results item 3.3.2.73. The staff finds the applicant's response acceptable because it clarified that the subject components are within scope.

SGs are generally equipped with flow restrictors, one of whose intended functions is to limit steam line flow during a steam line rupture. Over the extended life of the plant, it is essential to maintain the flow area of the flow restrictors used in the CLB to calculate the amount of steam released. The staff also believes that such components are susceptible to aging effects such as loss of material and cracking. Accordingly, in RAI 2.3.1.2-3, the staff requested the applicant to provide the following information:

- Are the SGs at FCS equipped with such components?

- If so, include the components within the scope of license renewal and subject to an AMR, so that the intended function mentioned above can be maintained over the period of extended operation, or provide a justification for their exclusion.

In response, the applicant stated that the FCS flow limiters are of the venturi type and are fabricated of Inconel.   They are built into the piping downstream of the first elbow in the horizontal main steam system piping runs leaving the steam generators. For license renewal, they are treated as part of the piping in which they are contained. This piping, including the limiters, is included in Table 2.3.4.3-1 of the LRA, "Main Steam and Turbine Steam Extraction," under the component type "Pipes & Fittings." The applicant further stated that the flow limiters are credited for a main steam line break by limiting the cross sectional area equivalent to 50 percent of that of the inside diameter of the main steam piping such that steam flow is restricted to less than $11x10^6$ pounds per hour following a main steam line break incident. As a result, the applicant agreed to add "Flow Restriction" as a license renewal intended function in Table 2.3.4.3-1 of the LRA. The applicant, however, concluded that since the venturi is fabricated of Inconel, there are no plausible aging effects in the secondary side steam flow environment, and as a result, no AMP is needed to manage the venturi throat diameter.

By letter dated February 20, 2003, the staff requested that the applicant submit the revised LRA Table 2.3.4.3-1, showing "Flow Restriction" as an intended function to be maintained during the period of extended operation and provide a corresponding link in the table. The link should take the reader to an appropriate subsection within Section 3 of the LRA, "Aging Management Review," for a discussion as to why the applicant believes that no AMP is required. This was identified as POI-2. By letter dated March 14, 2003, the applicant responded to POI-2 by providing the revised LRA Table 2.3.4.3-1. The revised table included "Flow Restriction" as a component intended function. On this basis, the staff considers POI-2 resolved. The response also stated that loss of material due to FAC is not a plausible aging effect for the venturi because it's made of Inconel. The staff agrees that the venturi is not subject to loss of material due to FAC because it's made of Inconel, and Inconel materials are not susceptible to loss of material due to FAC because they have a high chromium content, which makes them inherently more resistant to loss of material due to FAC. Therefore, an AMP is not required.

2.3.1.2.3 Conclusions

The staff reviewed the LRA, the supporting information in the USAR, the applicant's response to the staff's RAI and POI, to determine whether any SSCs that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of its review, the staff concludes that the applicant has adequately identified the RCS components that are within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the RCS components that are subject to an aging management review, as required by 10 CFR 54.21(a)(1).

2.3.1.3 Reactor Vessel

The applicant describes the reactor vessel (RV) in LRA Section 2.3.1.3 and provides a list of components subject to an AMR in LRA Table 2.3.1.3-1.

2.3.1.3.1 Summary of Technical Information in the Application

The RV is a 140-inch beltline inner diameter two-loop vessel. This configuration has four coolant inlet nozzles and two coolant outlet nozzles. The vessel comprises a removable head with multiple penetrations (control element drive mechanisms, in-core instrumentation nozzles, and the reactor vessel vent line); upper, intermediate, and lower shell courses; and bottom head and vessel supports. The vessel includes two leakage detection lines that are located between the vessel flange O-rings. The vessel is an all welded, manganese molybdenum-nickel steel plate and forging construction. Welds were made with submerged arc welding processes using manganese-molybdenum-nickel (Mn-Mo-Ni) steel consumable wire, a Linde welding flux, and shield metal arc repair welds. The interior surfaces of the vessel in contact with reactor coolant are clad with austenitic stainless steel.

The major system interfaces with the RV are the RCS and the RVI.

More information about the RV can be found in USAR Section 4.

The list of RV component types subject to aging management review and their intended functions are shown in Table 2.3.1.3-1 of the LRA. The component types which were identified for the RV include closure studs, CEDM housing studs, ICI studs, CEDM nozzles, core stabilizing lugs, core support lugs, ICI and RC vent nozzles, keyways and core barrel support ledge, pipes and fittings, CEDM housings, primary nozzle supports, RV closure head lift rig pads, RV closure head, RV lower shell, RV middle shell, RV bottom head, RV flange, and associated cladding, RV nozzle safe ends, RV nozzles and associated cladding, and surveillance capsule holders.

The intended functions identified for the RV components were pressure boundary, fission product retention, limit vibration, core displacement, structural support, and non-safety affecting safety.

2.3.1.3.2 Staff Evaluation

The staff reviewed this section of the LRA to determine whether the RV and supporting structures within the scope of license renewal and subject to an AMR have been identified in accordance with the requirements of 10 CFR 54.4 and 10 CFR 54.21(a)(1), respectively. This was accomplished as described below.

As part of the evaluation, the staff determined whether the applicant had properly identified the systems, structures, and components within the scope of license renewal and subject to an AMR, pursuant to 10 CFR 54.4(a) and 10 CFR 54.21(a)(1). The staff reviewed the relevant portions of the USAR for FCS for the RV and associated pressure boundary components and compared the information in the USAR with the information in the LRA to identify those portions that the LRA did not identify as being within the scope of license renewal and subject to an AMR. The staff then reviewed the structures and components that were identified as not being within the scope of license renewal to verify that these structures and components do not have any of the intended functions delineated under 10 CFR 54.4(a), and for those structures and components that have an applicable intended function(s), to verify that they either perform this function(s) with moving parts or a change in configuration or properties, or that they are subject to replacement based on a qualified life or specified time period, as described in 10 CFR 54.21(a)(1).

The staff also reviewed the USAR for any functions delineated under 10 CFR 54.4(a) that were not identified as intended functions in the LRA, to verify that the systems, structures, and components with such functions will be adequately managed so that the functions will be maintained consistent with the CLB for the period of extended operation.

After completing the initial review, the staff requested the applicant to provide additional information on the RV. By letter dated December 19, 2002, the applicant responded to the staff's RAI as discussed below.

LRA Section 2.3.1.3 states that the vessel includes two leakage detection lines that are located between the vessel flange O-rings. The staff believes that the inner O-ring, the leakoff lines, and the outer O-ring all support the reactor vessel closure head flange pressure boundary (see letter dated October 27, 1999, from the NRC to the Babcock & Wilcox Owners Group (B&WOG)). Although in select cases the staff has accepted a site-specific technical justification, in general, the leakoff lines require an aging management review. It appears that the leakage detection lines at FCS have not been identified in the LRA (Table 2.3.1.3-1) as within scope, nor has a plant-specific justification been provided. In RAI 2.3.1.3-1, the staff requested the applicant to provide a site-specific technical justification for FCS as to why aging management is not required, or perform an aging management review for these components. In response, the applicant stated that the leakage detection lines, or closure head vent lines, have been included within the scope of license renewal and are addressed in LRA Table 2.3.1.3-1 under the component type "Pipes & Fittings, CEDM Housings." The applicable components are linked to AMR results items 3.1.1.01, 3.1.1.06, and 3.1.1.14. The staff finds the applicant's response acceptable because it clarified that the subject components are within scope.

The staff did not identify any omissions.

2.3.1.3.3 Conclusions

The staff reviewed the LRA, the supporting information in the FCS USAR, and the applicant's responses to the staff's RAI to determine whether any SSCs that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On this basis, the staff concludes that the applicant has adequately identified the RV components that are within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the RV components that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.3.1.4 Evaluation Findings

On the basis of this review, the staff concludes that the applicant has adequately identified the reactor systems and components that are within the scope of license renewal, in accordance with the requirements of 10 CFR 54.4(a), and that the applicant has adequately identified the reactor system components that are subject to an aging management review, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.2 Engineered Safety Features Systems

In LRA Section 2.3.2, "Engineered Safety Features Systems," the applicant described the SSCs of the engineered safety features (ESF) that are subject to an AMR.

ESF systems consist of systems and components designed to function under accident condition to minimize the severity of an accident or to mitigate the consequences of an accident. In the event of a loss-of-coolant accident (LOCA), the ESF systems provide emergency coolant to assure structural integrity of the core, to maintain the integrity of the containment, and to reduce the concentration of fission products expelled to the containment building atmosphere. This subsection of the LRA includes the safety injection and containment spray (SI&CS) system and the containment penetration, and system interface components for non-CQE systems.

2.3.2.1 Safety Injection and Containment Spray

2.3.2.1.1 Summary of Technical Information in the Application

As described in the LRA, the safety injection (SI) system injects borated water into the RCS to provide emergency core cooling following a LOCA. This provides core cooling to ensure there is no significant alteration of core geometry, no clad melting, no fuel melting, and less than 1 percent cladding water reaction. This also limits fission product release and ensures adequate shutdown margin regardless of temperature. The SI system also provides continuous long-term post-accident cooling of the core by recirculation of borated water from the containment recirculation line inlet located in the containment sump.

The major components of the SI system are the three high-pressure safety injection (HPSI) pumps, two low-pressure safety injection (LPSI) pumps, four safety injection tanks, four safety injection leakage coolers, eight HPSI control valves, four LPSI control valves, and other various valves, instrumentation, and piping.

During normal plant operation, the SI system is maintained in a standby mode with all of its components lined up for emergency injection. In standby mode, none of the major system components are operating. Following an incident that results in a safety injection actuation signal (SIAS), the HPSI and LPSI pumps automatically start, and the high-pressure and low-pressure injection valves automatically open.

During the injection mode of operation, the HPSI and LPSI pumps take suction from the safety injection and refueling water tank (SIRWT) (the SIRWT is addressed in Section 2.4.2 of the LRA, “Auxiliary Building”) and inject borated water into the RCS via the safety injection nozzles located on the RCS cold legs.

The four safety injection tanks constitute a passive injection system since no electrical signal, operator action, or outside power source is required for the tanks to function. The tanks are designed to inject large quantities of borated water to cover the core in the event of a rapid depressurization of the RCS due to a large break LOCA.

The function of the containment spray (CS) system is to limit the containment structure pressure rise by providing a means for cooling the containment atmosphere after the occurrence of a LOCA. Pressure reduction is accomplished by spraying cool, borated water into the containment atmosphere. Heat removal is accomplished by recirculating and cooling the water through the shutdown cooling heat exchangers. The CS system also reduces the leakage of airborne radioactivity by effectively removing radioactive particulates from the containment atmosphere. Removal of radioactive particulates is accomplished by spraying water into the containment atmosphere. The particulates become attached to the water droplets, which fall to the floor and are washed into the containment sump.

The CS system consists of three spray pumps, two shutdown cooling heat exchangers and all necessary piping, valves, instruments, and accessories. The pumps discharge the borated water through the two heat exchangers, during recirculation, to a dual set of spray headers and spray nozzles in the containment. These spray headers are supported from the containment roof and are arranged to give essentially complete spray coverage of the containment horizontal cross sectional area.

More information about SI&CS can be found in USAR Section 6.2 and USAR Section 6.3, respectively.

The SI&CS component types subject to an AMR and their intended functions are shown in Table 2.3.2.1-1 of the LRA. The component types which were identified for the SI&CS include leakage accumulators, bolting, filter/strainer, flow element/orifice, heat exchanger, orifice plate, pipes and fittings, pump casings, injection tanks, tubing, and valve bodies.

The intended functions identified for the SI&CS components were pressure boundary/fission product retention, filtration, heat transfer, and flow restriction.

2.3.2.1.2 Staff Evaluation

The staff reviewed this section of the LRA to determine whether the SI&CS components and supporting structures within the scope of license renewal and subject to an AMR have been identified in accordance with the requirements of 10 CFR 54.4 and 10 CFR 54.21(a)(1), respectively. This was accomplished as described below.

As part of the evaluation, the staff determined whether the applicant had properly identified the systems, structures, and components within the scope of license renewal and subject to an AMR, pursuant to 10 CFR 54.4(a) and 10 CFR 54.21(a)(1). The staff reviewed the relevant portions of the USAR for the SI&CS and associated pressure boundary components and compared the information in the USAR with the information in the LRA to identify those portions that the LRA did not identify as being within the scope of license renewal and subject to an AMR. The staff then reviewed the structures and components that were identified as not being within the scope of license renewal to verify that these structures and components do not have any of the intended functions delineated under 10 CFR 54.4(a), and for those structures and components that have an applicable intended function(s), to verify that they either perform this function(s) with moving parts or a change in configuration or properties, or that they are subject to replacement based on a qualified life or specified time period, as described in 10 CFR 54.21(a)(1).

The staff also reviewed the USAR for any function(s) delineated under 10 CFR 54.4 (a) that were not identified as intended function(s) in the LRA, to verify that the systems, structures, and components with such function(s) will be adequately managed so that the function(s) will be maintained consistent with the CLB for the period of extended operation.

After completing the initial review, the staff requested the applicant to provide additional information on the SI&CS. By letter dated December 19, 2002, the applicant responded to the staff's RAI as discussed below.

LRA Section 2.3.2.1 states that the function of the CS system is to limit the containment structure pressure rise by providing a means for cooling the containment atmosphere after the occurrence of a LOCA. Pressure reduction is accomplished by spraying cool, borated water into the containment atmosphere. The CS system also reduces the leakage of airborne radioactivity by effectively removing radioactive particulates from the containment atmosphere. Removal of radioactive particulates is accomplished by spraying water into the containment atmosphere. The particulates become attached to the water droplets, which fall to the floor and are washed into the containment sump. During recirculation, the CS pumps discharge the borated water through two heat exchangers to a dual set of spray headers and spray nozzles in the containment. These spray headers are supported from the containment roof and are arranged to give essentially complete spray coverage of the containment horizontal cross sectional area. The staff believes that the above-mentioned statements in the LRA justify the need to include the spray headers and spray nozzles within the scope of license renewal and that an aging management review should be submitted in order to preserve the spraying function from degradation due to cracking, corrosion, loss of material, and/or blockage. However, it appears that the subject components and the intended functions were not identified in LRA Table 2.3.2.1-1 as being within scope and requiring aging management. In RAI 2.3.2.1-1, the staff requested the applicant to include these components within scope and subject to an AMR, or to identify the component type under which the subject components are included in the LRA. In response, the applicant clarified that the containment spray ring and nozzles are within the scope of license renewal and that they are included in LRA Table 2.3.2.1-1 under the component type, “Pipes & Fittings.” The applicable components are linked to AMR results items 3.2.1.01, 3.2.1.10, and 3.2.2.04. The staff finds the applicant’s response acceptable because it clarified that the subject components are within scope.

The staff did not identify any omissions.

2.3.2.1.3 Conclusions

The staff reviewed the LRA, the supporting information in the FCS USAR, and the applicant’s responses to the staff’s RAI, to determine whether any SSCs that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On this basis, the staff concludes that the applicant has adequately identified the SI&CS components that are within the scope of license renewal as required by 10 CFR 54.4(a) and that the applicant has adequately identified the SI&CS components that are subject to an AMR as required by 10 CFR 54.21(a)(1).

2.3.2.2 Containment Penetration and System Interface Components for Non-CQE Systems

2.3.2.2.1 Summary of Technical Information in the Application

The applicant describes the containment penetration and system interface components for non-CQE systems in LRA Section 2.3.2.2 and provides a list of components subject to an AMR in LRA Table 2.3.2.2-1.

The containment penetration and system interface components for the non-CQE systems group includes the containment isolation valves of the feedwater blowdown, compressed air, blowpipe, and demineralized water systems, as well as the piping between the containment penetrations and the containment isolation valves. The CQE heat exchangers in the demineralized water system are included to maintain the CCW system pressure boundary. The mechanical portions of all electrical penetrations that provide containment isolation are also included.

2.3.2.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.2.2 to determine whether the components of the containment penetration and system interface components for non- CQE systems within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1), respectively.

In the performance of the review, the staff selected system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted.

2.3.2.2.3 Conclusions

The staff reviewed the LRA and the accompanying scoping boundary drawings to determine whether any structures, systems, or components that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the applicant has adequately identified the components of the containment penetration and system interface components for non-CQE systems that are within the scope of license renewal as required by 10 CFR 54.4(a) and that the applicant has adequately identified the components of the containment penetration and system interface components for non-CQE systems that are subject to an aging management review as required by 10 CFR 54.21(a)(1).

2.3.2.3 Evaluation Findings

On the basis of this review, the staff concludes that the applicant has adequately identified the engineered safety features systems and components that are within the scope of license renewal in accordance with the requirements of 10 CFR 54.4(a) and that the applicant has adequately identified the components of the engineered safety features systems that are subject to an aging management review in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.3 Auxiliary Systems

In LRA Section 2.3.3, "Auxiliary Systems," the applicant described the SSCs of the auxiliary systems that are subject to an AMR for license renewal.

Auxiliary systems are those systems used to support normal and emergency plant operations. The systems provide cooling, ventilation, sampling, and other required functions. The following systems are included in this subsection of the LRA.

- chemical and volume control (CVCS)
- spent fuel pool cooling (SFPC)
- emergency diesel generators (EDGs)
- diesel generator lube oil and fuel oil (DGLO and DGFO)
- auxiliary boiler fuel oil and fire protection fuel oil
- diesel jacket water
- diesel starting air
- instrument air (IA)
- nitrogen gas (NG)
- containment ventilation
- auxiliary building ventilation
- control room HVAC and toxic gas monitoring
- ventilating air
- fire protection (FP)
- raw water (RW)
- component cooling water (CCW)
- liquid waste disposal (LWD)
- gaseous waste disposal (GWD)

- primary sampling (PS)
- radiation monitoring–mechanical

2.3.3.1 Chemical and Volume Control

2.3.3.1.1 Summary of Technical Information in the Application

The applicant describes the CVCS in LRA Section 2.3.3.1 and provides a list of components subject to an AMR in LRA Table 2.3.3.1-1

As described in the LRA, the CVCS maintains desired water level, water chemistry/purity, and boron concentration in the reactor coolant through continuous feed-and-bleed operation. The CVCS includes one regenerative heat exchanger, one letdown heat exchanger, five ion exchangers, two purification filters, one volume control tank, three positive-displacement charging pumps, one boric acid batching tank, two boric acid storage tanks, two centrifugal boric acid transfer pumps, one chemical additional tank with metering pump, piping, valves, instrumentation, and controls.

More information about the CVCS can be found in USAR Section 9.2.

The CVCS component types subject to an AMR and their intended functions are shown in LRA Table 2.3.3.1-1. The component types which were identified for the CVCS include bolting, filter/strainer housing, flow element/orifice, heat exchanger, ion exchangers, pipes, fittings and tubing, pump casings, tanks, and valve bodies.

The intended functions identified for the CVCS components were pressure boundary, filtration, and heat transfer.

2.3.3.1.2 Staff Evaluation

The staff reviewed this section of the LRA to determine whether the CVCS components and supporting structures within the scope of license renewal and subject to an AMR have been identified in accordance with the requirements of 10 CFR 54.4 and 10 CFR 54.21(a)(1), respectively. This was accomplished as described below.

As part of the evaluation, the staff determined whether the applicant had properly identified the systems, structures, and components within the scope of license renewal and subject to an AMR, pursuant to 10 CFR 54.4(a) and 10 CFR 54.21(a)(1). The staff reviewed the relevant portions of the USAR for the CVCS and associated pressure boundary components and compared the information in the USAR with the information in the LRA to identify those portions that the LRA did not identify as being within the scope of license renewal and subject to an AMR. The staff then reviewed the structures and components that were identified as not being within the scope of license renewal to verify that these structures and components do not have any of the intended functions delineated under 10 CFR 54.4(a), and for those structures and components that have an applicable intended function(s), to verify that they either perform this function(s) with moving parts or a change in configuration or properties, or that they are subject to replacement based on a qualified life or specified time period, as described in 10 CFR 54.21(a)(1).

The staff also reviewed the USAR for any function(s) delineated under 10 CFR 54.4 (a) that were not identified as intended function(s) in the LRA, to verify that the systems, structures, and components with such function(s) will be adequately managed so that the function(s) will be maintained consistent with the CLB for the period of extended operation.

After completing the initial review, the staff requested the applicant to provide additional information on the CVCS. By letter dated December 19, 2002, the applicant responded to the staff's RAI as discussed below.

On drawing E-23866-210-121, Sheet 2, the de-borating filter is not included in the scope for pressure boundary function. The drawing shows normally open valves with no signal to close on either side of the de-borating filter. In RAI 2.3.3.1-1, the staff stated its belief that this portion of the system meets the 10 CFR 54.4(a) scoping criteria and should be included within scope. Further, the staff also believed that the filter housing is passive and long-lived and, thus, should be subject to an AMR. The applicant, therefore, should include this component within the scope of license renewal and subject to an AMR or justify its exclusion. In response, the applicant stated that the borated water filter housing is not in scope for license renewal because the filter is not used. Its isolation valves are normally closed. It was further stated that drawing E-23866-210-121, Sheet 2, has been revised to show valves CH-131 and CH-134 (the filter isolation valves) as normally closed. A copy of this drawing has been provided.

The staff reviewed the applicant's response and finds it acceptable because it clarified that the subject components are not used.

The staff did not identify any omissions.

2.3.3.1.3 Conclusions

The staff reviewed the LRA, the supporting information in the FCS USAR, and the applicant's response to the staff's RAI to determine whether any SSCs that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On this basis, the staff concludes that the applicant has adequately identified the CVCS components that are within the scope of license renewal as required by 10 CFR 54.4(a) and that the applicant has adequately identified the CVCS components that are subject to an AMR as required by 10 CFR 54.21(a)(1).

2.3.3.2 Spent Fuel Pool Cooling

2.3.3.2.1 Summary of Technical Information in the Application

The applicant describes the spent fuel pool cooling system in LRA Section 2.3.3.2 and provides a list of components subject to an AMR in LRA Table 2.3.3.2-1.

The SFPC system consists of a stainless-steel-lined storage pool, two storage pool circulation pumps, a storage pool heat exchanger, a demineralizer and filter, two fuel transfer canal drain pumps, piping, manual valves, and instrumentation. The pool concrete and liner are evaluated with the auxiliary building. The storage pool pumps circulate borated water through the storage pool heat exchanger and return it to the pool. Cooling water to the heat exchanger is provided by the CCW system. The purity and clarity is maintained by diverting a portion of the circulated water through the demineralizer and the filter.

The fuel transfer canal drain pumps are used to provide pool makeup water from the SIRWT and also to drain the fuel transfer canal and return the refueling water to the SIRWT or the radioactive waste disposal system.

2.3.3.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.2 and USAR Section 9.6 to determine whether the spent fuel pool cooling system components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1), respectively.

In the performance of the review, the staff selected system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted.

During its review of LRA Section 2.3.3.2 and referenced drawings, the staff determined that additional information was needed to complete its review. The drawings referenced by the LRA identify the portions of each system that the applicant determined to be within the scope defined by 10 CFR 54.4, and the applicant prepared a separate license renewal boundary drawing for each system appearing on a single piping and instrumentation drawing. The staff identified discrepancies between the license renewal drawings for the safety injection and spent fuel pool cooling systems on Piping and Instrumentation Drawing (P&ID)11405-M-11 and between the license renewal drawings for the safety injection, spent fuel pool cooling, and liquid waste disposal systems on P&ID 11405-M-6, Sheet 2. In a letter dated October 11, 2002, the staff asked the applicant to clarify whether the embedded piping adjacent to valve AC-307 on P&ID 11405-M-11 (RAI 2.3.3.2-1) and whether the piping between valves WD-843 and WD-1161, including the spent fuel pool cooling system branch piping from drawing 11405-M-11, on P&ID 11405-M-6, Sheet 2 (RAI 2.3.3.2-2), are within the scope of license renewal and subject to an AMR.

By letter dated November 22, 2002, the applicant responded to RAI 2.3.3.2-1 by stating that the embedded piping adjacent to valve AC-307 on P&ID 11405-M-11 is within the scope of license renewal and subject to an AMR. By a separate letter dated November 22, 2002, the applicant provided a revised version of license renewal P&ID 11405-M-11 for the spent fuel pool cooling system that corrected the identified discrepancy. The staff reviewed the information provided in response to the RAI and finds it acceptable because it corrected the discrepancies identified by the staff and clarified the components that are within scope.

By letter dated December 12, 2002, the applicant responded to RAI 2.3.3.2-2 by stating that the piping between valves WD-843 and WD-1161, including the spent fuel pool cooling system branch piping from P&ID 11405-M-11, on P&ID 11405-M-6, Sheet 2, is within the scope of license renewal and subject to an AMR. By a separate letter dated December 12, 2002, the applicant provided revised license renewal boundary drawings for the spent fuel pool cooling, safety injection, and liquid waste disposal systems on P&ID 11405-M-6, Sheet 2, that corrected the identified discrepancies. The staff determined that the applicant’s response was acceptable because it corrected the discrepancies identified by the staff and clarified the components that are within scope.

2.3.3.2.3 Conclusions

The staff reviewed the LRA and the accompanying scoping boundary drawings to determine whether any structures, systems, or components that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the applicant has adequately identified the components of the spent fuel pool cooling system that are within the scope of license renewal as required by 10 CFR 54.4(a) and that the applicant has adequately identified the components of the spent fuel pool cooling system that are subject to an aging management review as required by 10 CFR 54.21(a)(1).

2.3.3.3 Emergency Diesel Generators

2.3.3.3.1 Summary of Technical Information in the Application

The applicant describes the EDGs in LRA Section 2.3.3.3 and provides a list of components subject to an AMR in LRA Table 2.3.3.3-1.

The EDGs are designed to furnish reliable in-plant alternating current (AC) power adequate for safe plant shutdown and for operation of engineered safeguards when no energy is available from the 345 kV or 161 kV systems. For adequate reliability, two units are provided. Each unit is connected to one of the two separate 4160 V systems between which engineered safeguards and other essential auxiliaries are divided. The division of loads is such that operation of either system alone provides the minimum engineered safeguards requirement.

Each EDG is provided with an exhaust silencer, an engine control panel, an exciter, an electrical panel, and auxiliaries. Each EDG interfaces with an integral cooling system, two starting-air systems, a lubricating system, two fuel systems between the engine mounted fuel oil tanks, and the engine fuel lines. Both EDGs are supplied fuel from a common, underground fuel oil storage tank by redundant transfer pumps. No external energy source other than 125V direct current (DC) control power is required for starting or subsequent operation of the EDGs. Immersion heaters are provided to maintain engine jacket water and lubricating oil temperatures at desirable temperatures for quick, reliable starting. The EDGs are located in separate rooms of the auxiliary building.

The Rule recognizes that the EDGs are active and excludes them from the group of equipment that is subject to an AMR. The auxiliary subsystems for the EDGs are treated as separate systems from the EDG (i.e., EDG jacket water, EDG fuel and lube oil, and EDG starting air). The auxiliary subsystems stop at the connection to the engine skid. The components on the engine side of the auxiliary subsystem connection are considered part of the EDGs for the purposes of license renewal.

2.3.3.3.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.3 and USAR Section 8.4.1 to determine whether the EDG components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1), respectively. This was accomplished as described below.

In the performance of the review, the staff selected system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted.

During its review of LRA Section 2.3.3.3, the staff determined that additional information regarding the components (expansion joints and mufflers) was needed to complete its review. These components were identified in Drawing E-4183, Revision 1, “Diesel Generator Intake Air & Exhaust Diagram,” as being within the scope of license renewal; however, they were not included in LRA Table 2.3.3.3-1, which lists components subject to an AMR. The staff believed that expansion joints and mufflers should be subject to an AMR. By a letter dated October 11, 2002, in RAI 2.3.3.3-1, the staff requested the applicant to clarify whether these components were subject to an AMR or to justify their exclusion.

In its response dated November 22, 2002, the applicant stated that the expansion joints and mufflers are included in LRA Table 2.3.3.3-1 under the component type “Pipes and Fittings.” The expansion joints and mufflers are managed for aging per the AMR results items listed for the component type. The staff finds this clarification (i.e., that these components are within the scope of license renewal and subject to an AMR) acceptable.

Also, the staff found that the components (inlet air filter boxes, turbocharger housing, exhaust reducers, aftercoolers, radiator exhaust ductworks, and EDG air boxes) were neither identified in drawing E-4183 as being within the scope of license renewal nor included in LRA Table 2.3.3.3-1. The staff believed that these components should be subject to an AMR. In the October 11, 2002, letter, in RAI 2.3.3.3-2, the staff also requested the applicant to clarify whether these components were subject to an AMR or to justify their exclusion.

In its response dated November 22, 2002, the applicant stated that although not shown on the referenced drawing as being within the scope of license renewal, the air inlet filter boxes, turbochargers, aftercoolers, air boxes, exhaust manifolds, and crankcases are part of the diesel engine, which is an active component, and therefore, not subject to an AMR. The exhaust reducers are within the scope of license renewal and are included in LRA Table 2.3.3.3-1 under the component type “Pipes and Fittings.” The radiator exhaust ductworks are within the scope of license renewal and are included with the ventilating air system, LRA Table 2.3.3.13-1, under the component type “Ducts and Fittings.” They are indicated as being within the scope of license renewal in drawing 11405-M-97, Sheet. 2.

The staff concurs with the applicant that the above-cited components (air inlet filter boxes, turbochargers, aftercoolers, air boxes, exhaust manifolds, and crankcases) are part of the diesel engine and, therefore, not subject to an AMR. In addition, the staff finds the applicant’s clarification that the exhaust reducers and radiator exhaust ductwork are within the scope of license renewal and subject to an AMR, acceptable.

2.3.3.3.3 Conclusions

The staff reviewed the LRA, the supporting information in the FCS USAR, and the applicant’s responses to the staff’s RAIs to determine whether any SSCs that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On this basis, the staff concludes that the applicant has adequately identified the EDG components that are within the scope of license renewal as required by 10 CFR 54.4(a) and that the applicant has adequately identified the EDG components that are subject to an AMR as required by 10 CFR 54.21(a)(1).

2.3.3.4 Emergency Diesel Generator Lube Oil and Fuel Oil

2.3.3.4.1 Summary of Technical Information in the Application

The applicant describes the DGLO and fuel oil DGFO system in LRA Section 2.3.3.4 and provides a list of components subject to an AMR in LRA Table 2.3.3.4-1.

The DGLO system lubricates the diesel engine components and filters and cools the engine lube oil. The lube oil system supports operation of the EDGs, which provide a reliable source of 4160 VAC power for safe plant shutdown and operation of engineered safeguards when the normal sources of offsite power are lost.

The DGFO system provides fuel to the engine in the proper amount to maintain engine speed and load. The fuel oil system supports operation of the EDGs, which provide a reliable source of 4160 VAC power for safe plant shutdown and operation of engineered safeguards when the normal sources of offsite power are lost. An 18,000-gallon underground storage tank serves both engines. This tank can be replenished from the auxiliary boiler fuel oil storage tank if necessary. Two transfer pumps for each diesel transfer fuel from the underground storage tank to a wall-mounted auxiliary tank. Fuel gravity-drains from the wall-mounted tank to the engine base tank. One engine-driven fuel oil pump and one motor-driven fuel oil pump deliver fuel to the engine fuel injectors.

2.3.3.4.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.4 and USAR Section 8.4.1 to determine whether the emergency diesel generator lube oil and fuel oil system components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1), respectively. This was accomplished as described below.

In the performance of the review, the staff selected system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted.

During its review of LRA Section 2.3.3.4, the staff determined that additional information regarding the air box drain drums and camshaft counter weight housings was needed to complete its review. These components were identified in drawing B120F03001, Sheets 1 and 2, “Lube Oil System Schematic,” as being within the scope of license renewal; however, they were not included in LRA Table 2.3.3.4-1, which lists components subject to an AMR. The staff believed that these components are passive and long-lived and therefore should be subject to an AMR. In the October 11, 2002, letter, in RAI 2.3.3.4-1, the staff requested the applicant to clarify whether these components were subject to an AMR or to justify their exclusion.

In its response dated December 19, 2002, the applicant stated that the air box drain drums are included in LRA Table 2.3.3.4-1 under the component type “Tanks” and are managed for aging per the AMR results items 3.3.1.05 and 3.3.1.07. The camshaft counter weight housing is considered to be part of the engine. For this reason, consistent with the response to RAI 2.3.3.4-1 above, it is not subject to AMR.

Based on the review of the applicant's rationale, the staff concurs with the applicant that the camshaft counter weight housing is part of the diesel engine and therefore not subject to an AMR. In addition, the staff finds the above applicant's clarification that the air box drain drums are within the scope of license renewal and subject to an AMR, acceptable.

2.3.3.4.3 Conclusions

The staff reviewed the LRA, the supporting information in the FCS USAR, and the applicant's response to the staff's RAI to determine whether any SSCs that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On this basis, the staff concludes that the applicant has adequately identified the DGLO and DGFO components that are within the scope of license renewal as required by 10 CFR 54.4(a) and that the applicant has adequately identified the DGLO and DGFO components that are subject to an AMR as required by 10 CFR 54.21(a)(1).

2.3.3.5 Auxiliary Boiler Fuel Oil and Fire Protection Fuel Oil

2.3.3.5.1 Summary of Technical Information in the Application

The applicant describes the auxiliary boiler fuel oil and fire protection fuel oil in LRA Section 2.3.3.5 and provides a list of components subject to an AMR in LRA Table 2.3.3.5-1.

The fire protection fuel oil (FP-FO) system supplies fuel oil to the diesel engine fire pump. The pump is located at the north end of the intake structure and takes its suction from a chamber immediately inside the traveling screens. The fire pump's diesel engine is independent of site power. A 10-gallon fuel oil day tank for the diesel engine is located adjacent to the engine. Fuel oil is transferred from the diesel fire pump fuel oil tank to the day tank. The 550-gallon capacity diesel fire pump fuel oil tank is located outside the intake structure and is contained within an enclosure.

The license renewal boundary of the FP-FO system includes the diesel fire pump fuel oil tank; the priming tank and its hand pump; the fuel oil day tank; the fuel transfer pump; and the filter, valves, and piping between the diesel fire pump fuel oil tank and the injector unit of the fire pump diesel engine.

The auxiliary boiler fuel oil (AB-FO) system stores and delivers diesel fuel oil for operation of the plant auxiliary boiler. The AB-FO storage tank also stores fuel oil for the EDGs. The system consists of an 18,000-gallon underground fuel storage tank, two fuel transfer pumps, piping, valves, and instrumentation for delivery of fuel oil to the auxiliary boiler. In addition, the license renewal boundary consists of a fuel oil transfer pump, piping, filters, instrumentation, and warehoused equipment for delivery of fuel oil from the auxiliary boiler fuel oil storage tank to the diesel engine fuel oil storage tank. The AB-FO system license renewal boundary includes the AB-FO storage tank; below-grade piping associated with the tank; and filters, pumps, valves and piping between the AB-FO storage tank and the AB-FO supply solenoid valve. In addition, the pump, filters, and valves within the supply pipeline from the AB-FO storage tank through the fuel oil transfer pump discharge valve are included.

2.3.3.5.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.5 to determine whether the AB-FO and FP-FO system components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1), respectively.

In the performance of the review, the staff selected system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted.

During the review of LRA Section 2.3.3.5, the staff determined that additional information was needed to complete the review. The staff found that the LRA description stated the intended function of the individual components but did not state the license renewal intended function of the system. Additionally, the LRA description did not provide sufficient information on the license renewal intended function of the system to determine whether all the components required by 10 CFR 54.4 to be within the scope of license renewal and subject to an AMR have been correctly identified. By letter dated October 11, 2002, the staff requested in RAI 2.3.3.5-1 that the applicant provide more information concerning the intended function(s) of this system. In a letter dated November 22, 2002, the applicant stated that the license renewal intended function of the AB-FO system is to provide a backup fuel oil supply to the diesel generators. Therefore, the components included within the scope of license renewal are the AB-FO oil storage tank; below-grade piping associated with the tank; and the filters, pumps, valves, and piping between the AB-FO storage tank and the AB-FO supply solenoid valve since these comprise a pressure boundary that must be maintained to ensure the integrity of the supply system. In addition, the pump, filters, and valves within the supply pipeline from the AB-FO storage tank through the fuel oil transfer pump discharge valve are included since these comprise a pressure boundary to transfer fuel oil from the AB-FO storage tank to the diesel generator fuel oil day tank. Based on the above information, the staff was able to complete its review.

LRA Table 2.3.3.5-1 states that hose and hose couplings will be replaced based on performance or condition in accordance with the periodic surveillance and preventive maintenance program. In accordance with the guidance provided in Table 2.1-3 of the SRP-LR, hoses and hose couplings are consumable components and, as such, are typically replaced based on performance or condition monitoring that identifies whether these components are at the end of their qualified lives and may be excluded, on a plant-specific basis, from an AMR. The guidance further states that the applicant should identify the standards that are relied on for the replacement as part of the methodology description. Since the periodic surveillance and preventive maintenance program, as described in the LRA, did not provide such a methodology description, the staff requested the applicant in RAI 2.3.3.5-2 to identify the standards that are relied on for replacement. In a letter dated November 22, 2002, the applicant responded that the hoses and hose couplings identified in LRA Table 2.3.3.5-1 are inspected for fraying, cracking, splitting, embrittlement, corrosion damage, or degradation which could prevent them from performing their intended function. This inspection is performed per approved plant procedures in accordance with the periodic surveillance and preventive maintenance program. Condition determination is made by craft and engineering judgement and, if necessary, the hose and/or couplings are replaced based on condition in accordance with the corrective action program. The staff finds this response acceptable because the applicant has a proceduralized mechanism to replace consumable parts.

2.3.3.5.3 Conclusions

The staff reviewed the LRA and the accompanying scoping boundary drawings to determine whether any structures, systems, or components that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the applicant has adequately identified the components of the AB-FO and FP-FO systems that are within the scope of license renewal as required by 10 CFR 54.4(a) and that the applicant has adequately identified the components of the AB-FO and FP-FO systems that are subject to an aging management review as required by 10 CFR 54.21(a)(1).

2.3.3.6 Emergency Diesel Generator Jacket Water

2.3.3.6.1 Summary of Technical Information in the Application

The applicant describes the EDG jacket water system in LRA Section 2.3.3.6 and provides a list of components subject to an AMR in LRA Table 2.3.3.6-1.

The EDG jacket water system for each EDG provides cooling to the engine in order to ensure that the diesel rated load can be maintained. Each jacket water system supports operation of an EDG, which provides a reliable source of 4160 V power for safe plant shutdown and operation of engineered safeguards when the normal sources of offsite power are lost. Each engine has its own self-contained radiator-type cooling system.

2.3.3.6.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.6 and USAR Section 8.4.1 to determine whether the emergency diesel jacket water system components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1), respectively. This was accomplished as described below.

In the performance of the review, the staff selected system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted.

During its review of LRA Section 2.3.3.6, the staff determined that additional information regarding the instrument manifolds was needed to complete its review. Instrument manifolds are identified in Drawing B120F04002, Sheets 1 and 2, “Jacket Water Schematic,” as being within the scope of license renewal. However, the instrument manifolds were not included in LRA Table 2.3.3.6-1, which lists components subject to an AMR. The staff believed that these components were passive and long-lived and therefore should be subject to an AMR. In the October 11, 2002, letter, the staff requested the applicant to clarify whether the instrument manifolds were subject to an AMR or to justify their exclusion.

In its response dated December 19, 2002, the applicant stated that the instrument manifolds are included in LRA Table 2.3.3.6-1 under the component type “Pipes and Fittings” and are managed for aging per the AMR results items 3.3.2.29 and 3.3.2.30. The staff finds the applicant’s clarification that the instrument manifolds are within the scope of license renewal, and subject to an AMR, acceptable.

2.3.3.6.3 Conclusions

The staff reviewed the LRA, the supporting information in the FCS USAR, and the applicant’s responses to the staff’s RAI to determine whether any SSCs that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On this basis, the staff concludes that the applicant has adequately identified the EDG jacket water components that are within the scope of license renewal as required by 10 CFR 54.4(a) and that the applicant has adequately identified the EDG jacket water components that are subject to an AMR as required by 10 CFR 54.21(a)(1).

2.3.3.7 Starting Air

2.3.3.7.1 Summary of Technical Information in the Application

The applicant describes the starting air system in LRA Section 2.3.3.7 and provides a list of components subject to an AMR in LRA Table 2.3.3.7-1.

The starting air system provides stored pressurized air for starting the EDGs. Each diesel is provided with a system that contains redundant air storage, piping, air start motors, and compressors for charging the storage tanks. Each tank has the capacity for 5 starts of the diesel (combining for a total of 10 emergency starts). Because 10 starts is the design basis requirement, those portions of the system used for charging the storage tanks are non-CQE and are not required for the diesels to meet the design basis. Therefore, the compressors and associated equipment are not included within the license renewal scope.

2.3.3.7.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.7 and USAR Section 8.1.4 to determine whether the starting air system components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1), respectively. This was accomplished as described below.

In the performance of the review, the staff selected system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted.

During its review of LRA Section 2.3.3.7, the staff determined that additional information regarding filters/strainers was needed to complete its review. LRA Table 2.3.3.7-1 includes filters/strainers; however, these components are not shown in drawing B120F07001, Sheets 1 and 2, “Starting Air System Schematic,” as being within the scope of license renewal. In the

October 11, 2002, letter, in RAI 2.3.3.7-1, the staff requested the applicant to clarify whether the filters/strainers were subject to an AMR or to justify their exclusion.

In its response dated November 22, 2002, the applicant stated that not all filters shown on the drawing are in scope. For example, the oil removal filters, SA-2-2-F, are not in scope as shown on B120F07001, Sheets 1 and 2. The filters that are in scope, as shown on these drawings, are included in LRA Table 2.3.3.7-1 under the component type "Filters/Strainers." They are managed for aging per the LRA AMR items listed for the component type.

Based on the review of the applicant's response, the staff finds the above applicant's clarification regarding filters/strainers acceptable.

2.3.3.7.3 Conclusions

The staff reviewed the LRA, the supporting information in the FCS USAR, and the applicant's responses to the staff's RAI to determine whether any SSCs that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On this basis, the staff concludes that the applicant has adequately identified the starting air system components that are within the scope of license renewal as required by 10 CFR 54.4(a) and that the applicant has adequately identified the starting air system components that are subject to an AMR as required by 10 CFR 54.21(a)(1).

2.3.3.8 Instrument Air

2.3.3.8.1 Summary of Technical Information in the Application

The applicant describes the IA system in LRA Section 2.3.3.8 and provides a list of components subject to an AMR in LRA Table 2.3.3.8-1.

The IA system provides oil-free, filtered, and dried air for pneumatic controls, instrumentation, and the actuation of valves, dampers and similar devices. The IA system is considered to be that equipment required to store and deliver air to pneumatic instruments, controls, valves, and dampers. The CA system supplies compressed air to and interfaces with the IA system at the IA distribution system downstream of the after-filter sets. Instrument air is distributed to the various pneumatic components it serves through a network of supply headers and distribution risers. The IA system also feeds the suction of the compressors for the starting air system (starting air is evaluated as a separate system in Section 2.3.3.7 of this SER).

Backup accumulators containing IA or nitrogen are provided on selected pneumatic devices to ensure their operability if IA pressure drops.

Drawing 11405-M-264, Sheet 1, "Instrument Air Diagram Auxiliary Building and Containment P&ID," shows the license renewal boundary for the system penetration into the containment building. The remainder of the IA components within scope for license renewal are associated with air-operated valves (AOVs). The IA piping and components for the individual valves are not shown on P&IDs. Typical IA supply configurations for AOVs are shown on drawing C-4175, Sheet 1, "Typical Control Valve Air Source Valve Configurations P&ID." The styles shown on that drawing cover the bulk of AOV-related items which are within scope for license renewal.

The boundary flags on that drawing illustrate where the typical license renewal boundaries are for AOV-related items. There are several non-AOV-related pneumatic items in scope for license renewal, but the license renewal boundary locations for those items are generally similar to those for AOVs.

2.3.3.8.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.8 and USAR Section 9.12 to determine whether the IA system components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1), respectively.

In the performance of the review, the staff selected system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted.

During the review of LRA Section 2.3.3.8, the staff determined that additional information was needed to complete the review. By letter dated October 11, 2002, the staff issued RAIs 2.3.3.8-1 and 2.3.3.8-2 on the CA and IA systems, respectively. LRA Section 2.3.2.2 states that containment isolation valves and associated piping in the CA system are subject to an AMR. LRA Section 2.3.3.8 states that the function of the CA system is to serve as the source of air for the IA system. Section 9.12 of the USAR describes the CA system to include air compressors, receivers, and air dryers. The staff requested the applicant to justify the exclusion of these components, as well as valve bodies, piping, bolting, and valve operator bodies of the CA system, from the scope of license renewal. The staff also requested more information concerning the intended function of this system. In a letter dated November 22, 2002, the applicant responded that as described in Section 9.12 of the USAR, the non-safety-related CA system provides compressed air to the instrument air and the service air headers. The instrument air header provides air for pneumatic controls and the actuation of valves, dampers, and similar devices, as well as the fuel-handling machine in containment. The CA system is not relied on to perform any intended function as defined in 10 CFR 54.4. The air compressors are not loaded onto the EDGs, and during a design basis event, the CA system is assumed to be unavailable. Because the air supply is unavailable during a design basis event, all air-operated valves and dampers required to control design basis events are (1) designed to fail to the required post-accident position on loss of air pressure, (2) provided with safety grade instrument air accumulators, or (3) provided with nitrogen backup systems. Most of the IA system is not safety-related and does not meet the scoping criteria for license renewal. The portions of the IA system that meet the scoping requirements of 10 CFR 54.4 are those components required to operate engineered safety features or essential safeguards and are included within the scope of license renewal. Drawing C-4175, Sheet 1, shows how boundaries for the typical arrangement were scoped. The boundaries were determined to occur at a check valve or trip valve, as applicable. For the IA system, the component types determined to be in scope are accumulators (tanks, bolting, filter housing, pipes and fittings, tubing, valve bodies, and valve operators). Pressure boundary is the only intended function for license renewal. On the basis of the information provided in response to RAIs 2.3.3.8-1 and 2.3.3.8-2, the staff finds that the applicant has provided adequate justification for the exclusion of components in the CA system, and provided information on the IA and CA system functions. On the basis of this additional information, the staff concludes that the applicant has adequately identified the SSCs within the IA system that are within the scope of license renewal and subject to an AMR.

2.3.3.8.3 Conclusions

The staff reviewed the LRA and the accompanying scoping boundary drawings to determine whether any structures, systems, or components that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the applicant has adequately identified the components of the IA system that are within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the components of the IA system that are subject to an aging management review, as required by 10 CFR 54.21(a)(1).

2.3.3.9 Nitrogen Gas

2.3.3.9.1 Summary of Technical Information in the Application

The applicant describes the NG system in LRA Section 2.3.3.9 and provides a list of components subject to an AMR in LRA Table 2.3.3.9-1.

The NG system is used to charge the safety injection tanks to provide the passive motive force to discharge the contents of the safety injection tanks to re-flood the reactor during an unexpected depressurization of the RCS. It also provides a continuous nitrogen gas supply to various contained areas or vessels within the plant for the control of oxygen to minimize general corrosion. The NG system consists of valves, piping, instruments, and controls. Nitrogen gas is also used for multiple valves in the plant as a backup to the IA system. The NG system components that provide that backup are covered in the IA results, which are covered in LRA Section 2.3.3.8 and evaluated in Section 2.3.3.8 of this SER.

2.3.3.9.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.9 to determine whether the NG system components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1), respectively.

In the performance of the review, the staff selected system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted.

During the review of LRA Section 2.3.3.9, the staff determined that additional information was needed to complete the review. By letter dated October 11, 2002, the staff issued RAI 2.3.3.9-1. The system description in LRA Section 2.3.3.9 describes the function of the NG system to be to charge the safety injection tanks and to provide nitrogen cover for various tanks. In the review, the staff noted that the referenced drawings show the license renewal boundaries only going from the tanks to the first isolation valve. The staff also found that the LRA description stated the intended function of the individual components but did not state the license renewal intended function of the system. The staff requested information concerning the intended function of this system. In a letter dated November 22, 2002, the applicant responded that the license renewal intended function of the NG system is to maintain the pressure boundary of the nitrogen gas supply lines providing nitrogen to the various tanks. Therefore, the portions of the nitrogen gas system within the scope of license renewal are the supply lines from the tanks, which are supplied with nitrogen gas by this system, to the first isolation valve. On the basis of this information, the staff was able to complete its review.

During the review, the staff found that on Drawing 11405-M-42, Sheet 1, Location C3, valve NG-116 was highlighted as being within the scope of license renewal. The upstream and downstream side piping connected to NG-116 is not highlighted as being within the scope of license renewal. According to LRA Table 2.3.3.9-1, the intended function of the valve body component group is pressure boundary. The failure to include the connected piping within scope and subject to an AMR could defeat that function. The staff requested in RAI 2.3.3.9-2 that the applicant include the subject piping within the scope of license renewal and subject to an AMR or provide justification for not including the connected piping within the license renewal boundary. In a letter dated November 22, 2002, the applicant responded that the referenced drawing has an error at that location. The license renewal boundary flag on the downstream side of NG-116 should not end as shown but continue on and direct the reader to the CVCS. The staff finds the response acceptable because it clarifies the scope of the license renewal boundary for the NG system.

2.3.3.9.3 Conclusions

The staff reviewed the LRA and the accompanying scoping boundary drawings to determine whether any structures, systems, or components that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the applicant has adequately identified the components of the NG system that are within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the components of the NG system that are subject to an aging management review, as required by 10 CFR 54.21(a)(1).

2.3.3.10 Containment Heating, Ventilation, and Air Conditioning

2.3.3.10.1 Summary of Technical Information in the Application

The applicant describes the containment HVAC system in LRA Section 2.3.3.10 and provides a list of components subject to an AMR in LRA Table 2.3.3.10-1.

The function of the containment HVAC system is to provide ventilation and cooling of the containment. The containment HVAC system consists of four separate subsystems. These subsystems are (1) containment air recirculating and cooling, (2) nuclear detector well cooling, (3) containment purge, and (4) hydrogen purge. In the context of engineering safeguards, during a design basis event, the containment HVAC system removes heat released to the containment atmosphere, restricts leakage of airborne activity from containment, reduces fission product inventory in the containment atmosphere, controls the concentration of hydrogen, and provides measurement of specific containment parameters such as pressure and temperature. During normal plant operations, the containment HVAC system also maintains the concrete temperature in the biological shield surrounding the reactor vessel.

2.3.3.10.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.10 and USAR Section 9.10 to determine whether the containment HVAC system components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1), respectively.

In the performance of the review, the staff selected system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted.

During the review of LRA Section 2.3.3.10, the staff determined that additional information was needed to complete the review. The staff asked the applicant in a letter dated October 11, 2002, to clarify if the nuclear well cooling subsystem is included within the scope of license renewal since it was described as part of the containment HVAC system but not highlighted on the accompanying drawings (RAI 2.3.3.10-1). By letter dated December 19, 2002, the applicant responded that the SCs in question should be within the scope of license renewal and subject to an AMR. The applicant provided the appropriate drawing correction with its response. The staff determined that the applicant's response was acceptable because it provided the clarifications needed by the staff to determine that the nuclear well cooling subsystem is within scope.

The staff also asked the applicant in a letter dated October 11, 2002, to clarify if dampers as listed in the table are subject to an AMR since they are active components and to clarify if damper housings should be included on the list as being subject to an AMR (RAI 2.3.3.10-2). By letter dated December 19, 2002, the applicant responded that dampers are subject to an AMR due to the pressure boundary function provided by their bodies/housings. This is indicated by the pressure boundary function identified in the table. The staff determined the applicant's response was acceptable because it clarified whether the dampers and their housings are within scope.

The staff asked the applicant in a letter dated October 11, 2002, to clarify if the fan or blower housings of the fans that provide flow to the seismic skirt are subject to an AMR and to identify if other components associated with this function are subject to an AMR (RAI 2.3.3.10-3). By letter dated December 19, 2002, the applicant responded that fan and blower housings are subject to an AMR by the pressure boundary function and are included in LRA Table 2.3.3.10-1. The staff determined the applicant's response was acceptable because it clarified what components are subject to an AMR.

2.3.3.10.3 Conclusions

The staff reviewed the LRA and the accompanying scoping boundary drawings to determine whether any structures, systems, or components that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the applicant has adequately identified the components of the containment HVAC system that are within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the components of the HVAC system that are subject to an aging management review, as required by 10 CFR 54.21(a)(1).

2.3.3.11 Auxiliary Building Heating, Ventilation, and Air Conditioning

2.3.3.11.1 Summary of Technical Information in the Application

The applicant describes the auxiliary building HVAC in LRA Section 2.3.3.11 and provides a list of components subject to an AMR in LRA Table 2.3.3.11-1.

The auxiliary building is ventilated and cooled with ambient outside air. It is divided into two zoned systems for ventilation purposes. These are in the controlled access area and the uncontrolled access area. Both systems are of the once-through, nonrecirculating type using supply and exhaust fans. Portions of the auxiliary building HVAC system are utilized by the hydrogen purge system, which is an ESF system and is part of the plant’s engineered safeguards.

Controlled access area system:

The controlled access area ventilation supply system consists of an air handling unit containing roughing filters and preheat and reheat steam coil banks, two 50 percent capacity vane axial fans, and distribution ductwork. The exhaust system consists of three 33-1/3 percent capacity vane axial fans drawing air through return ducts from each ventilated space to a common filtering unit containing high-efficiency particulate air (HEPA) filters. The exhaust air is continuously monitored for radioactive contamination at the ventilation discharge duct before discharge to the atmosphere.

Charcoal filters are installed in normally bypassed ducts at the exhaust of the safety injection and spray pump rooms and the spent regenerate tank room. These filters can be manually aligned remotely in the event of an accidental release of activity in these rooms (see USAR Section 9.10-1).

A charcoal filter is also installed in a normally bypassed section of the return ductwork drawing air from the spent fuel storage pool area. A differential pressure gauge is installed across each filter to provide a means of determining the condition of each filter (see USAR Sections 9.10-1 and 9.10-9).

Uncontrolled access area system:

The uncontrolled access area system is similar to that in the controlled access area, except that shutoff dampers are not installed, the exhaust is not filtered, and a single roof mounted centrifugal exhaust fan is employed.

Part of the uncontrolled access area, Room 81, houses a ventilation fan that is utilized in an Appendix R scenario to provide, if necessary, fresh air and help limit temperature rise. The applicant described the process for identifying the mechanical components within the scope of license renewal in LRA Section 2.1.5.1, “Mechanical Systems,” referencing the criteria identified in LRA Section 2.1.3.2, “10 CFR 54.4" which reflects the Federal regulations pertinent to licensing renewal.

2.3.3.11.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.11 and USAR Sections 9.10-1 and 9.10-9 to determine whether the auxiliary building HVAC system components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1).

In the performance of the review, the staff selected system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted.

During the review of LRA Section 2.3.3.11, the staff determined that additional information was needed to complete the review. The staff asked the applicant in a letter dated October 11, 2002, to clarify highlighted portions of referenced drawings to determine if continuation portions not highlighted should be included within the scope of license renewal (RAI 2.3.3.11-1). By letter dated December 19, 2002, the applicant responded that Drawing 11405-M-2, Sheet 2, was in error and provided a corrected drawing. The staff also asked the applicant as part of this RAI to clarify if dampers, as listed in the table, are subject to an AMR since they are active components and to clarify if damper housings should be included on the list as being subject to an AMR. The applicant responded that the response to RAI 2.3.3.10-2 was applicable in this case. The response to RAI 2.3.3.10-2 stated that dampers are subject to AMR because the pressure boundary function provided by their bodies/housings was applicable. The staff determined the applicant’s response was acceptable because it clarified what components are within scope and subject to an AMR.

2.3.3.11.3 Conclusions

The staff reviewed the LRA and the accompanying scoping boundary drawings to determine whether any structures, systems, or components that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the applicant has adequately identified the components of the auxiliary building HVAC system that are within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the components of the auxiliary building HVAC system that are subject to an aging management review, as required by 10 CFR 54.21(a)(1).

2.3.3.12 Control Room Heating, Ventilation, and Air Conditioning, and Toxic Gas Monitoring

2.3.3.12.1 Summary of Technical Information in the Application

The applicant describes the control room HVAC and toxic gas monitoring system in LRA Section 2.3.3.12 and provides a list of components subject to an AMR in LRA Table 2.3.3.12-1.

The control room HVAC system conditions three individually controlled temperature zones: shift manager/mezzanine/lunchroom areas (Zone 1), the main control room area (Zone 2), and the computer room (Zone 3). Part of the air supply for Zone 2 is ducted through the control panels and instrumentation cabinets to provide direct cooling of the enclosed equipment.

The toxic gas monitoring system provides a means of protecting the control room operators from an accidental release of toxic gas to meet NUREG-0737, Item III.D.3. The toxic gas monitoring system includes redundant ammonia detectors located inside the control room, with tubing run from the detectors to the fresh air intake to the control room HVAC system.

2.3.3.12.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.12 and USAR Sections 9.10 and 9.23 to determine whether the control building HVAC and toxic gas monitoring system components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1), respectively.

In the performance of the review, the staff selected system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted.

During its review, the staff determined that additional information was needed to complete its review. The staff asked the applicant in a letter dated October 11, 2002, to describe the areas that constitute the main control room envelope (MCRE) and verify that all components which have safety-related functions and are subject to an AMR are identified in LRA Table 2.3.3.12-1 (RAI 2.3.3.12-1). By letter dated December 19, 2002, the applicant described the areas constituting the MCRE and clarified that housings for the components are included within the component types. The housings are subject to an AMR for a pressure boundary intended function. The staff determined the applicant’s response was acceptable because it clarified what components are included within the MCRE and are subject to an AMR.

The staff also asked the applicant in a letter dated October 11, 2002, to clarify whether sealant materials used to maintain the MCRE at positive pressure are included within the scope of license renewal (RAI 2.3.3.12-1). By letter dated December 19, 2002, the applicant responded that the elastomer (neoprene) seal and flex connections in the control room HVAC system are within scope for license renewal and linked to LRA Table 3.3-1, Item 3.3.1.02. In addition, fire barrier penetration seals used to maintain the MCRE pressure boundary are within scope and linked to LRA Table 3.3-1, Item 3.3.1.19. The staff determined the applicant’s response was acceptable because it clarified what components are within scope.

2.3.3.12.3 Conclusions

The staff reviewed the LRA and the accompanying scoping boundary drawings to determine whether any structures, systems, or components that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the applicant has adequately identified the components of the control room HVAC and toxic gas monitoring system that are within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the components of the control room HVAC and toxic gas monitoring system that are subject to an aging management review, as required by 10 CFR 54.21(a)(1).

2.3.3.13 Ventilating Air

2.3.3.13.1 Summary of Technical Information in the Application

The applicant describes the ventilating air (VA) system in LRA Section 2.3.3.13 and provides a list of components subject to an AMR in LRA Table 2.3.3.13-1.

The VA system is designed to maintain a suitable environment for equipment and personnel. Although the VA system consists of equipment located in numerous areas, the passive equipment within the license renewal boundary is contained within the EDG rooms. This equipment is identified as EDG air inlet louvers and radiator exhaust dampers (including the ductwork). The safety-related function of the EDG air inlet louvers is to admit air to the EDG rooms of the auxiliary building for combustion and cooling of the EDGs. The safety-related function of the radiator exhaust dampers (located in the radiator exhaust ducts) and ductwork is to discharge exhaust air from the EDG radiators to the outside atmosphere.

2.3.3.13.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.13 and USAR Section 9.10 to determine whether the VA system components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1), respectively.

In the performance of the review, the staff selected system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted.

During its review, the staff determined that additional information and/or clarification was needed to complete the review. The staff asked the applicant in a letter dated October 11, 2002, if the housing for exhaust fans in the EDG rooms should be included within the scope of license renewal (RAI 2.3.3.13-1). By letter dated December 19, 2002, the applicant responded that there are no fans within the scope of license renewal for this system, but in other systems where installed fans are within the scope of license renewal, their housings have also been included within scope. The staff determined the applicant's response was acceptable because it clarified that the fan housings do not perform an intended function and therefore are not included within scope.

2.3.3.13.3 Conclusions

The staff reviewed the LRA and the accompanying scoping boundary drawings to determine whether any structures, systems, or components that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the applicant has adequately identified the components of the VA system that are within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the components of the VA system that are subject to an aging management review, as required by 10 CFR 54.21(a)(1).

2.3.3.14 Fire Protection

2.3.3.14.1 Summary of Technical Information in the Application

The applicant describes the FP system in LRA Section 2.3.3.14 and provides a list of components subject to an AMR in LRA Table 2.3.3.14-1.

The FP system provides the means for detecting, alarming, isolating, and suppressing fires in the plant. The system comprises the following subsystems and attributes:

- The fire detection and alarm system is an instrumentation system that alerts control room operators of a fire and indicates its location.

- The fire suppression system includes fire-fighting equipment such as automatic sprinklers, automatic halon systems, standpipe hose stations, and outside fire hydrants.

- Fire rated assemblies are features of plant design and construction (e.g., fire barriers) which contribute to the separation of fire hazards into zones and fire areas and are addressed as part of the structure. Fire doors, fire dampers, and penetration seals provide the necessary closures associated with openings in the fire rated barriers. Fire dampers are addressed in LRA Section 2.3.3.12, “Auxiliary Building HVAC,” and fire barriers including penetration seals and fire doors are addressed in LRA Section 2.4.2.1, “Auxiliary Building.”

- The RCP lube oil collection subsystem is designed to collect oil from the RCPs and drain it to a collection tank to prevent a fire in the containment building during normal plant operations. This system is provided to comply with 10 CFR 50, Appendix R, Section III.0, “Oil Collection System for Reactor Coolant Pump.”

The FP system at FCS is relied upon to meet the requirements of 10 CFR 50.48, “Fire Protection Rule,” and Appendix R to Part 50, “Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979." In accordance with 10 CFR 50.48, the plant is divided into unique fire areas as required by Appendix A of Branch Technical Position (BTP) APCSB 9.5-1, "FP for Nuclear Power Plants.” The SSCs satisfying the safe shutdown requirements of Appendix R are contained in the safe shutdown equipment list (SSEL) and captured by the review conducted for 10 CFR 54.4(a)(1) and 10 CFR 54.4(a)(2). The non-CQE FP SSCs required for compliance with 10 CFR 50.48 are identified in the FHA and are captured within the scope of license renewal. FCS is licensed to 10 CFR 50.48(b) as specifically stated in SERs and their respective facility operating license. In accordance with the FCS license condition, the USAR also contains the provisions of the NRC-approved FP program.

2.3.3.14.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.14 and USAR Section 9.11 to determine whether the FP system components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1), respectively. The staff sampled portions of the USAR to identify any additional FP system function that met the scoping requirements of 10 CFR 54.4 but was not identified as an intended function in the LRA.

The staff also reviewed SERs referenced for the FP program, which were listed directly in the FCS FP license condition. These SERs summarize the FP program and commitments made to meet 10 CFR 50.48 using the guidelines of Appendix A to BTP APCSB 9.5-1 and Appendix R. The staff sampled portions of these SERs to verify that the functions of the FP components relied upon to satisfy the provisions of Appendix A to BTP APCSB 9.5-1 and Appendix R were included within the scope of license renewal as intended functions in the LRA.

In a letter dated October 11, 2002, the staff requested in RAI 2.3.3.14-1 that the applicant clarify how plant commitments contained in drawings, the USAR, and other plant documentation which may also reflect the FCS FP CLB were reviewed to ensure that all FP SSCs relied upon for compliance with 10 CFR 50.48 were included within the scope of license renewal. In a letter to the NRC dated November 22, 2002, the applicant stated that it reviewed all applicable sources which reflect its CLB. It responded that the scoping documents are the FCS USAR, Updated Fire Hazards Analysis (UFHA), Appendix R Safe Shutdown Analysis, and P&IDs per PED-GEI-67, “Mechanical Scoping for License Renewal.” In addition, the Resource Acquisition Management System (RAMS) database and the FP DBDs were also referred to for making scoping determinations. The applicant also stated that the UFHA is updated in accordance with PED-GEI-04, “Fire Protection System Interaction.” This procedure provides the direction for reviewing engineering design changes to the plant and incorporating any changes that affect the FP DBDs, including the UFHA, into those documents, where applicable.

In the staff’s October 11, 2002 letter to the applicant, the staff stated in RAI 2.3.3.14-2 and 2.3.3.14-3 that the exclusion of FP SSCs on the basis that their intended function is not required for the protection of safe shutdown equipment or safety-related equipment is not acceptable if the SSCs are required for compliance with 10 CFR 50.48 to protect equipment important to safety. In the RAI, the staff questioned the exclusion of piping leading to transformer sprinklers, the retard chambers, the fire protection jockey pump, and the CO_2 system for the turbine generator excitor. Furthermore, the staff requested that the applicant provide licensing and technical justification for the exclusion of components that were identified in the staff’s SERs as meeting the provisions of Appendix A to BTP APCSB 9.5-1 and Appendix R.

In letters dated November 22, 2002, and December 19, 2002, the applicant responded to the staff’s questions. After reviewing the staff’s licensing and technical basis which described how each of these components was tied to the FCS licensing basis, the applicant agreed to include the piping leading to transformer sprinklers, the retard chambers, and the fire protection jockey pump in the scope of license renewal. For the CO_2 system for the turbine generator excitor, the applicant adequately demonstrated to the staff that the CO_2 system was installed only to satisfy insurance and liability concerns. On November 8, 2002, the NRC completed a scoping inspection at FCS. During the scoping inspection, the applicant provided the NRC inspectors with modification completion report MR-FC-92-020, which shows that the original design did not include suppression for the turbine generator. This lack of protection was identified as a concern by American Nuclear Insurer’s and resulted in FCS installing a CO_2 system for the excitor in the early 1990s. Inspection Report 05000285-02-07, dated December 20, 2002, provides the details of the FP scoping inspection at FCS. Therefore, the applicant adequately demonstrated to the staff that the CO_2 system was never credited for compliance with 10 CFR 50.48, in accordance with the FCS CLB.

In accordance with the NRC letter from C.I. Grimes to D.J. Walters, NEI, "Consumables," dated March 10, 2000, system filters, fire extinguishers, fire hoses, and air packs are excluded from an AMR on the basis that these SCs are replaced based on a qualified life. In RAI 2.3.3.14-4, the staff asked the applicant to provide a methodology description and identify the National Fire Protection Association (NFPA) standards and plant implementing procedures that are relied upon for replacement. In its letter dated December 19, 2002, the applicant noted the applicable NFPA standard (NFPA 162, "Standard for the Care, Use, and Service Testing of Fire Hose Including Couplings and Nozzles") for hose replacement. In addition, the staff found that site-specific procedures for each of these SCs were already evaluated in LRA Section 2.1.6.4. The staff found the applicant's response consistent with the staff's letter on consumables and, therefore, acceptable.

2.3.3.14.3 Conclusion

The staff reviewed the LRA and the accompanying scoping boundary drawings to determine whether any structures, systems, or components that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the applicant has adequately identified the components of the FP system that are within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the components of the FP system that are subject to an aging management review, as required by 10 CFR 54.21(a)(1).

2.3.3.15 Raw Water

2.3.3.15.1 Summary of Technical Information in the Application

The applicant describes the raw water (RW) system in LRA Section 2.3.3.15 and provides a list of components subject to an AMR in LRA Table 2.3.3.15-1.

The RW system is an open-cycle cooling water system which uses screened water from the Missouri River. The system includes four parallel vertical mixed-flow pumps installed in the intake structure pump house. The pumps discharge into an interconnected header which splits into two parallel supply headers. The two supply headers run underground from the intake structure to the auxiliary building, where they join in an interconnected inlet header to the four CCW system heat exchangers.

Downstream of the CCW heat exchangers, the RW discharge header runs through the turbine building and discharges to the river via the circulating water discharge tunnel. RW piping and valves are also routed to selected equipment normally cooled by CCW to provide a means of direct cooling as a backup to CCW. The discharge from the direct cooling portion of the RW system is routed through its own separate discharge header via the turbine building into the circulating water discharge tunnel. In the unlikely event of a design basis accident (DBA), all four RW pumps are started automatically, and a safety injection actuation signal (SIAS) opens the RW isolation valves on all four CCW heat exchangers.

For license renewal purposes, the intake structure traveling screens are evaluated as part of the RW system. There are three cells in the intake structure for the intake of river water, and each cell is served by two traveling screens.

2.3.3.15.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.15 and USAR Section 9.8 to determine whether the RW system components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1), respectively.

In the performance of the review, the staff selected system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted.

As a result of this review, the staff questioned the applicant’s location of license renewal scoping boundaries on piping connected to a portion of the RW system discharge header piping passing through the auxiliary building and turbine building. These license renewal boundaries are located at design class boundaries, but the boundaries do not coincide with isolation valve locations. By letter dated October 11, 2002, the staff requested the applicant to justify the location of these license renewal boundaries with regard to protection of essential systems from internal flooding in the event of failure of the pressure boundary of the non-safety-related piping outside of the license renewal scope boundary (RAI 2.3.3.15-1).

By letter dated November 22, 2002, the applicant responded to this request by stating that an engineering analysis and a calculation have demonstrated that the design class boundaries are acceptable at a non-valve location. This analysis determined that internal flooding of the turbine building due to failure of the piping will not affect any safe shutdown equipment, nor will floods propagate from the turbine building to the auxiliary building. Additionally, the analysis showed that the floor drains in the auxiliary building can easily handle a postulated flood resulting from rupture of any of the lines that tie into the backup raw water header in the auxiliary building. Section 2.3.3.17 of the LRA states that the auxiliary building floor drains perform an intended function for flood mitigation, and referenced drawings show that the floor drains are within the license renewal scope boundaries. Finally, the analysis determined that a postulated break in any of the non-safety-related piping in question would not impair the ability of the RW system to perform its intended safety function.

The staff evaluated the above information and concluded that the failure of the pressure boundary of the non-safety-related piping outside of the license renewal scope boundary would not affect equipment necessary for safe shutdown or for mitigation of design basis events through flooding. However, during evaluation of this information, the staff noted that Section 2.3.3.15 of the LRA stated that the raw water (RW) discharge from the CCW system heat exchangers and the discharge from the direct cooling RW header flow into the circulating water discharge tunnel. Table 2.2-1 of the LRA designated the circulating water system as outside of license renewal scope without specific justification, but failure of the pressure boundary of buried piping or tunnels creates the potential for a loss of flow. Therefore, the location of the license renewal boundary at the discharge pipes for the RW system, rather than at the outlet from the circulating water discharge tunnel, had not been adequately justified. By letter dated February 20, 2003, the staff issued POI-3(a) requesting the applicant to justify the location of the license renewal boundary.

By letter dated March 14, 2003, the applicant responded to this POI, stating that the location for the RW discharge license renewal boundary at check valves CW-188 and CW-189, upstream of the circulating water discharge tunnel, had been revised. The applicant included the circulating water discharge tunnel within the scope of license renewal as part of the intake structure. The applicant referenced a separate letter dated March 14, 2003, which included revised boundary drawing 11405-M-100 and new boundary drawing 11405-M-257, Sh. 2, as attachments. These drawings showed that a continuous flow path from the RW system to the river outfall had been included within the scope of license renewal. This resolves the scoping issues associated with POI-3(a), but the expansion of scope introduced the need for evaluation of the applicant's AMR for the discharge tunnel.

In its POI response, the applicant provided the following discussion regarding the AMR for the discharge tunnel.

- The circulating water discharge tunnel is constructed of reinforced concrete with a nominal wall thickness of 2' or greater and nominal floor/ceiling thicknesses of 2'-6" or greater throughout. The concrete circulating water discharge tunnel walls, floor and ceiling are constructed of Type B concrete in accordance with ACI 201.2R as specified in NUREG-1557.

- The concrete is not exposed to aggressive river water or groundwater. The concrete that surrounds the embedded steel has a pH greater than or equal to 12.5. The concrete mix design specified a water-to-cement ratio of 0.44 and air entrainment of 5.00% + 1.00% for Class B concrete. The concrete at FCS was designed in accordance with ACI 318-63 (per USAR Section 5.3.1 Revision 0 and USAR Section 5.11.3.1 Revision 2).

- The maximum flow rate in the circulating water tunnel is well below the velocity of 25 fps required to initiate abrasion. The calculated highest water velocity for a closed conduit is in the warm water recirculating tunnel at 12.6 fps. Therefore, this aging effect is not credible.

- Per NUREG-1557, corrosion of embedded steel is not significant for concrete structures above or below grade that are exposed to a non-aggressive environment. A non-aggressive environment, as defined by NUREG-1557, is one with a pH greater than 11.5 or chlorides less than 500 ppm. NUREG-1557 also concludes that corrosion of embedded steel is not significant for concrete structures exposed to an aggressive environment but have a low water-to-cement ratio, adequate air entrainment, and designed in accordance with ACI 318-63 or ACI 349-85. A low water-to-cement ratio is defined as 0.35 to 0.45 and adequate air entrainment is defined as 3 to 6 percent. Therefore, corrosion of embedded steel is not credible.

- The freeze/thaw exposure category is "Severe" since the concrete of concern is in direct contact with the soil. Based on recent analyses, the groundwater and river water contain minimal amounts of chlorides (8.0 ppm and 14.0 ppm respectively), sulfates (79 ppm and 229 ppm respectively), and the pH is slightly alkaline (7.48 and 8.39 respectively); therefore, the exposure category for sulfates, chlorides, and acids is "Mild", and concrete degradation is not credible for the circulating water discharge tunnel.

- The total flow of the raw water equates to less than 5% of the total volume of the circulating water discharge tunnel.

Based on the installation conditions enumerated above, the conditions specified in NUREG-1557 have been satisfied; therefore, minimal or no aging effects will be realized in the circulating water discharge tunnel. Tunnel failure will not occur to the point that the raw water intended function would be impacted or jeopardized during the period of extended operation. To verify this assumption, the applicant committed to performing a one-time inspection of the circulating water discharge tunnel as part of the one-time inspection program (B.3.5).

The staff evaluated the information provided in response to POI-3(a) and found it acceptable because the applicant had brought the circulating water discharge tunnel within scope.

Therefore, POI-3(a) was resolved.   However, the staff still had to review the aging management results associated with the expanded scope. This was identified as Open Item 2.3.3.15-1.

By letter dated July 7, 2003, the applicant revised the response contained in its submittal dated March 14, 2003. The applicant has chosen to manage aging of the circulating water tunnel as part of the structures monitoring program instead of the one-time inspection program. The staff has reviewed the structures monitoring program to ensure that the scope of the program includes the circulating water tunnel. LRA Section B.2.10 describes the structures monitoring program. The program description states that it is consistent with GALL Program XI.S7, “RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants.” The scope of GALL program XI.S7 includes intake and discharge structures. Because the circulating water tunnel is a discharge structure, it falls within the scope of XI.S7.

As stated above, the additional structural components of the circulating water discharge tunnel that were brought into scope were included and evaluated as part of the intake structure. The staff confirmed that the circulating water structural components brought into scope were already identified in LRA Table 2.4.2.3-1 for the intake structure. Therefore, the aging management results for the intake structure are applicable to the circulating water discharge tunnel. As discussed in Section 3.5.2.4.2 of this SER, the staff has concluded that the applicant has demonstrated that the aging effects associated with the components in structures outside containment (including the intake structure) will be adequately managed so that their intended functions will continue to be performed in accordance with the CLB for the period of extended operation. On this basis, the staff concludes that the components associated with the circulating water discharge tunnel, as part of the intake structure, will also be adequately managed such that the components will continue to perform their intended functions for the period of extended operation. Open Item 2.3.3.15-1 is closed.

Section 9.8.2 of the USAR states that four RW pumps are installed in the intake structure to provide screened river water to the CCW heat exchangers. These screens perform an apparent intended function of preventing large debris from blocking flow through, or otherwise causing the failure of, the RW system. However, LRA Table 2.3.3.15-1 does not specifically identify the intake structure screens as components subject to an aging management review. In the letter dated October 11, 2002, the staff also requested the applicant to clarify whether the intake structure screens are within the scope of license renewal and subject to an aging management review (RAI 2.3.3.15-2). The applicant responded to this request on November 22, 2002, by stating that intake structure screens CW-2A, CW-2B, CW- 2C, CW-2D, CW-2E, and CW-2F are included within the “filters/strainers” component type in LRA Table 2.3.3.15-1. Since the intake structure screens are within scope for license renewal and subject to an aging management review, the staff determined the applicant’s response was acceptable.

NRC Inspection Report 50-285/02-07, which was focused on the scoping and screening process at FCS for license renewal, identified Inspection Open Item 50-285/02-07-04 related to warm water recirculation. During the colder winter months, a portion of the heated water in the circulating water discharge tunnel is directed to a release point upstream of the intake screens to warm the river water entering the intake structure. The purpose of this recirculation flow path is to prevent the formation of frazil ice, which can block raw water flow to the heat exchangers that help maintain adequate cooling for safety-related components. Currently, the applicant considers the systems, structures, and components supporting warm water recirculation not to be within the scope of license renewal. However, the staff found that design basis document

SDBD-STRUC-503, USAR Section 9.8 for the RW system, and USAR Section 10.2.3 for the circulating water system, discuss how warm water recirculation is used to prevent the blockage of the intake screens with surface or frazil ice.

During the scoping and screening and AMR inspections, the staff discussed with the applicant whether the SSCs that are needed to ensure warm water recirculation should be included within the scope of license renewal. The staff determined that the warm water recirculation issue is a 10 CFR Part 50 issue, in that the issue is relevant for the current operating term and not unique to license renewal. Therefore, the issue has been referred to the operating reactors staff for followup. Resolution of this issue will be incorporated into the applicant's CLB.

2.3.3.15.3 Conclusions

The staff reviewed the LRA and the accompanying scoping boundary drawings to determine whether any structures, systems, or components that should be within the scope of license renewal were not identified by the applicant. The staff found that the circulating water discharge tunnel has been omitted from scope. Subsequently, this component was include within scope. With the exception of the discharge tunnel, no omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the SSCs within the scope of license renewal have been identified, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the components of the RW system that are subject to an AMR, as required by 10 CFR 54.21(a)(1). The results of the staff's review of the aging management of the circulating water discharge tunnel will be provided as part of the resolution of Open Item 2.3.3.15-1.

2.3.3.16 Component Cooling Water

2.3.3.16.1 Summary of Technical Information in the Application

The applicant describes the CCW system in LRA Section 2.3.3.16 and provides a list of components subject to an AMR in LRA Table 2.3.3.16-1.

The CCW system (also known as the Auxiliary Coolant–Component Cooling Water System) is a closed loop system which transfers heat to the RW system from various plant components. It provides a monitored intermediate barrier between these fluids and the RW system. The system also serves as a cooling medium for the containment air coolers, steam generator blowdown sampling coolers, and the control room economizer coils. System components are rated for the maximum duty requirements that may occur during normal, shutdown, or accident modes of operation. The CCW system is a closed loop consisting of three motor-driven circulating pumps, four heat exchangers, a surge tank, valves, piping, instrumentation, and controls. The water in the system is demineralized and deaerated, and an inhibitor is added for protection against corrosion. Makeup is supplied to the surge tank through a level control valve from the demineralized water system. RW system piping and valves are also routed to selected equipment normally cooled by CCW to provide a means of direct cooling as a backup to CCW.

2.3.3.16.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.16 and USAR Section 9.7 to determine whether the component cooling system components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1), respectively.

In the performance of the review, the staff selected system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted. During its review of LRA Section 2.3.3.16 and referenced drawings, the staff determined that additional information was needed to complete its review. The drawings referenced by the LRA identify the portions of each system that the applicant determined to be within the scope defined by 10 CFR 54.4, and the applicant prepared a separate license renewal boundary drawing for each system appearing on a single piping and instrumentation drawing. The staff identified discrepancies between license renewal boundary drawings for the CCW system and the same drawing for a different but connected system and also at transitions to different license renewal boundary diagrams. The staff also noted one apparent omission. These discrepancies caused the staff to question whether certain components were within the scope of license renewal for the CCW system. In a letter dated October 11, 2002, the staff asked the applicant to clarify which components on the following drawings were within scope for the CCW system and subject to an AMR:

RAI 2.3.3.16-1 Drawing 11405-M-12, Sheet 1, for the CCW and primary plant sampling systems

RAI 2.3.3.16-3 Drawing 11405-M-40, Sheet 1, for the CCW system and Drawing 11405-M-1, Sheet 1, for the containment ventilation system

RAI 2.3.3.16-4 Drawing 11405-M-10, Sheet 2, for the CCW system and Drawing 11405-M-42, Sheet 1, for the nitrogen gas system

RAI 2.3.3.16-5 Drawing E-23866-210-120, Sheet 1, for the CVCS system and Drawing 11405-M-10, Sheet 3, for the CCW system

RAI 2.3.3.16-6 Drawing 11405-M-10, Sheet 3, for the CCW system and Drawing 11405-M-98, Sheet 1, for the waste gas disposal system

RAI 2.3.3.16-7 Relief valves and inlet piping for the shutdown cooling and spent fuel pool cooling heat exchangers on Drawing 11405-M-10, Sheet 3, for the CCW system

By letter dated November 22, 2002, the applicant responded to the above RAIs by clarifying the specific components that are within the scope of license renewal and subject to an AMR. By a separate letter dated November 22, 2002, the applicant provided revised versions of several of the above license renewal drawings when revisions were necessary to correct or clarify which components are within the scope of license renewal for the CCW system. The staff reviewed the applicant’s responses to the above RAI’s, and the revised drawings. The staff found the revised information clearly identified components the applicant considered within the scope of license renewal and subject to an AMR and noted no omissions.

Section 2.3.3.16 of the LRA references Drawing 11405-M-119 for the CCW system, which depicts the CEA seal coolers as within license renewal scope as part of the reactor vessel internals, and the associated CCW supply and return piping as within scope for the CCW system. However, LRA Table 2.3.1.1-1, which lists components constituting the reactor vessel internals, does not include the CEA seal coolers nor their intended function of maintaining the CCW system pressure boundary. Also, LRA Section 2.3.1.1 does not reference Drawing 11405-M-119. By letter dated October 11, 2002, the staff requested the applicant to clarify whether the CEDM seal coolers are included within the scope of license renewal and subject to an AMR and to submit more detailed information regarding the configuration of the seal coolers (RAI 2.3.3.16-2).

By letter dated December 19, 2002, the applicant responded by stating that Drawing 11405-M-119 incorrectly identified the CEDM seal housing assemblies as being included within the reactor vessel internals "system." They are actually included with the RV system, and the CEDM seal housing assembly coolers are within license renewal scope. The drawing has been corrected and was included as an enclosure to a separate letter dated December 19, 2002. This letter also included as an enclosure Drawing CND-E-2935, “Seal Housing Assembly Details,” which shows the configuration of this "cooler." It consists of a machined depression in the housing over which a nippled sleeve is fitted and welded into place such that a cooling water channel is created.

The applicant stated that the CEDM seal housing assembly is a subcomponent within the component type “Pipes and Fittings, CEDM Housings” in Table 2.3.1.3-1 of the LRA. It is fabricated of austenitic stainless steel, has an internal environment of borated, treated water >482 °F, and an external environment of containment air. The applicant also added the CEDM seal housing assembly cooling channel as a new subcomponent within the component type “Pipes and Fittings, CEDM Housings” in Table 2.3.1.3-1 of the LRA. It has an internal environment of nitrite-corrosion-inhibited, treated water (CCW). Its external environment is the external environment of the housing assembly itself.

The applicant described the intended function of these seal housing assembly coolers by stating that they have only a pressure boundary function for the CCW system and that they do not have an intended function of heat transfer because the cooling is important only to CEA driving or holding. On the basis of the applicant’s response, the staff concludes that the CEDM seal housing assemblies are included within scope and subject to an AMR. RAI 2.3.3.16-2 is resolved.

NRC Inspection Report 50-285/02-07, which was focused on the scoping and screening process at FCS for license renewal, identified Inspection Open Item 50-285/02-07-01 related to the CCW system pressure boundary for the safety injection tank leakage cooler subsystem. Boundary Drawing 11405-M-40, Sheet 3, indicated that the safety injection tank leakage cooler subsystem was excluded from the scope of license renewal. This included the four coolers, associated piping, valves, and instrumentation. CCW is supplied to the four leakage coolers via 3-inch piping at approximately 300 gpm. CCW will automatically isolate on a containment isolation signal. The inspectors asked what effect a pipe break in this non-safety-related subsystem would have on the CCW system. The applicant stated that if leakage were to occur, it would be noticed in the containment sump coupled with a change in flow that would be sensed by flow elements downstream of the coolers. However, due to the size of the containment sump, leakage may not be immediately noticed. Additionally, neither the flow indicators nor flow elements were included within scope. The applicant had not submitted sufficient information to demonstrate that loss of pressure boundary integrity within this non-safety-related subsystem would not prevent completion of the intended functions of the CCW system and, therefore, the subsystem could be excluded from the scope of license renewal in accordance with 10 CFR 54.4. By letter dated February 20, 2003, the staff issued POI-3(b) requesting the applicant to provide information demonstrating that loss of pressure boundary integrity for this system would not result in the loss of CCW intended functions.

By letter dated March 14, 2003, the applicant responded to POI-3(b) by stating that the portion of CCW that provides cooling to the safety injection leakage coolers has been included within the scope of license renewal and will be added to the CCW AMR. LRA Table 2.3.3.16-1 component types "Heat Exchanger," "Pipes and Fittings," and Valve Bodies," capture all of the components being brought into scope and subject to an AMR. The applicant referenced a separate letter dated March 14, 2003, which included revised boundary Drawing 11405-M-40, Sheet 3, as an attachment. This drawing shows that the entire safety injection leakage cooler subsystem has been included within scope for license renewal.

The staff reviewed the information provided in the POI response and finds it acceptable because the pressure boundary components of the SI leakage cooler subsystem of the CCW system have been brought within the scope of license renewal, these components were subject to an AMR, and the affected component types and associated environment had been previously captured in LRA Table 2.3.3.16-1. Therefore, POI-3(b) is resolved.

2.3.3.16.3 Conclusions

The staff reviewed the LRA, the applicant's responses to the staff's RAIs and POI, and the accompanying scoping boundary drawings to determine whether any structures, systems, or components that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the applicant has adequately identified the components of the CCW system that are within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the components of the component cooling system that are subject to an aging management review, as required by 10 CFR 54.21(a)(1).

2.3.3.17 Liquid Waste Disposal

2.3.3.17.1 Summary of Technical Information in the Application

The applicant describes the LWD system in LRA Section 2.3.3.17 and provides a list of components subject to an AMR in LRA Table 2.3.3.17-1.

The LWD system is used to collect, store, prepare for disposal, and dispose of liquid radioactive wastes. Radioactive liquid wastes are generated as a result of plant operation, repair, and maintenance activities. These wastes must be collected, stored, processed, monitored, and disposed of in order to protect the plant personnel and the general public from exposure to radiation. The LWD system is CQE at the containment penetration isolation valves. These portions of the LWD system must provide containment isolation in the event of a containment isolation actuation signal (CIAS). The containment isolation system was designed to prevent the release of radioactivity from containment, especially in the event of an accident. In the event of a LOCA, the release of radioactivity is mitigated by establishing containment integrity. The floor drains in the auxiliary building are part of the LWD system and perform an intended function for flood mitigation.

2.3.3.17.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.17 and USAR Section 11.1.2 to determine whether the LWD system components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1), respectively.

In the performance of the review, the staff selected system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted.

2.3.3.17.3 Conclusions

The staff reviewed the LRA and the accompanying scoping boundary drawings to determine whether any structures, systems, or components that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the applicant has adequately identified the components of the LWD system that are within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the components of the LWD system that are subject to an aging management review, as required by 10 CFR 54.21(a)(1).

2.3.3.18 Gaseous Waste Disposal

2.3.3.18.1 Summary of Technical Information in the Application

The applicant describes the GWD system in LRA Section 2.3.3.18 and provides a list of components subject to an AMR in LRA Table 2.3.3.18-1.

The GWD system includes the containment isolation valves that close on a CIAS and the piping between the containment penetrations and the containment isolation valves.

For license renewal purposes, the system boundary also includes the volume control tank (VCT) pressure control valve, isolation valve, and pressure instruments in the piping from the VCT to the GWD system. Also included are the waste gas compressor seal water heat exchangers that receive cooling water from the CCW system.

2.3.3.18.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.18 and USAR Section 11.1.3 to determine whether the GWD system components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1).

In the performance of the review, the staff selected system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted.

2.3.3.18.3 Conclusions

The staff reviewed the LRA and the accompanying scoping boundary drawings to determine whether any structures, systems, or components that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the applicant has adequately identified the components of the GWD system that are within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the components of the GWD system that are subject to an aging management review, as required by 10 CFR 54.21(a)(1).

2.3.3.19 Primary Sampling

2.3.3.19.1 Summary of Technical Information in the Application

The applicant describes the PS system in LRA Section 2.3.3.19 and provides a list of components subject to an AMR in LRA Table 2.3.3.19-1.

The PS system includes components used to sample reactor coolant and steam generator blowdown. Apparatus and piping that may contain radioactive fluids are shielded. The principal items of equipment are the primary sampling panel, the CVCS panel, the steam generator blowdown analyzer rack, the instrument panel, steam generator blowdown sample chiller, and the manual sampling sink and hood.

The boundary for the PS system includes the containment penetration isolation valves and upstream tubing up to and including the RCS hot leg sample flow control valves, RV vent sample flow control valve, pressurizer surge line sample flow control valve, and both steam generator blowdown sample isolation valves. Heat exchangers SL-3, -8A, and -8B, and sample cooler SL-51 shell side and tubes are in scope as pressure boundary for the CCW system.

2.3.3.19.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.19 and USAR Section 9.13.2.1 to determine whether the PS system components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1), respectively.

In the performance of the review, the staff selected system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted.

During its review, the staff identified several potential discrepancies in the drawings used by the applicant to show which PS system components are within the scope of license renewal. Drawing 11406-M-12, Sheet 1 shows sample heat exchangers SL-3, SL-8A, and SL-8B and sample cooler SL-51 as being within the scope of license renewal for the PS system. The intended functions of these components are heat transfer and pressure boundary. In all four cases, the PS system inlet and outlet piping is not identified as being within the scope of license renewal. The failure of this piping could compromise the pressure boundary function of the heat exchangers and sample chiller. By letter dated October 11, 2002, the staff issued RAI 2.3.3.19-1 to obtain clarification from the applicant. By letter dated November 22, 2002, the applicant stated that the heat exchangers were incorrectly identified as having a heat transfer intended function. Heat transfer is not an intended function for license renewal. In addition, the heat exchangers have a pressure boundary function for the CCW system, not for the PS system. The GALL Report has heat exchangers aligned with the process fluid system and not the cooling system. The drawing properly shows the within-scope boundaries, as required by GALL. The staff determined that the applicant's response was acceptable because it clarified component intended functions as well as provided the basis for the license renewal scoping boundaries.

2.3.3.19.3 Conclusions

The staff reviewed the LRA and the accompanying scoping boundary drawings to determine whether any structures, systems, or components that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the applicant has appropriately identified the components of the PS system that are within the scope of license renewal, as required by 10 CFR 54.4, and that the applicant has appropriately identified the components of the PS system that are subject to an aging management review, as required by 10 CFR 54.21(a)(1).

2.3.3.20 Radiation Monitoring – Mechanical

2.3.3.20.1 Summary of Technical Information in the Application

The applicant describes the radiation monitoring-mechanical system (RMS) in LRA Section 2.3.3.20 and provides a list of components subject to an AMR in LRA Table 2.3.3.20-1.

Permanently installed radiation monitors are provided for surveillance of plant effluents, critical process streams (process monitors), and personnel exposure levels in hazardous and potentially hazardous plant areas (area monitors). Monitoring and recording are required for liquid and gaseous releases. The monitoring program meets the requirements of 10 CFR Part 50, Appendix I, and the Off-Site Dose Calculation Manual (ODCM). Process monitors measure RCS and primary-to-secondary leakage. The RMS consists of the CQE radiation monitors and their supporting components.

2.3.3.20.2 Staff Evaluation

The staff reviewed LRA Section 2.3.3.20 and USAR Section 11.2.3 to determine whether the RMS components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1).

In the performance of the review, the staff selected system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted.

During its review, the staff identified several potential discrepancies in the drawings used by the applicant to show which RMS components are within the scope of license renewal. Drawing 11405-M-1, Sheet 2, is the only drawing listed as showing the license renewal boundaries for this system. The drawing shows only three equipment cabinets as being within the scope of license renewal. This was inconsistent with LRA Table 2.3.3.20-1 which listed five component types subject to aging management review. By letter dated October 11, 2002, the staff issued RAI 2.3.3.20-1 to obtain clarification from the applicant. By letter dated December 19, 2002, the applicant stated that the components in question are shown on three proprietary vendor drawings which show the interior of the three equipment cabinets. The drawings were provided as part of the applicant's response. The staff reviewed this response and the provided drawings. Based on this review, the staff determined that additional information is needed to complete the review. The specific information required is listed below.

- On all three of the vendor drawings, license renewal boundaries end in the middle of pipes with no physical means of isolation. Justify placing the boundaries at these locations.

- The housings for the gas samplers RE-052, RM-062, and RE-051 are within the scope of license renewal but are not listed in LRA Table 2.3.3.20-1. These housings appear to perform a pressure boundary and/or fission product retention function. Therefore, these housings should be listed in Table 2.3.4.1-1 as being subject to an AMR in accordance with 10CFR54.21. Justify not making the gas samplers housings subject to an AMR.

By letter dated February 20, 2003, the staff issued POI-3(c) requesting this information from the applicant. By letter dated March 14, 2003, the applicant provided the requested information. On the basis of the additional information, the staff finds that the applicant has included the five component types within scope and subject to an AMR. POI-3(c) is resolved.

2.3.3.20.3 Conclusions

The staff reviewed the LRA and the accompanying scoping boundary drawings to determine whether any structures, systems, or components that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the applicant has appropriately identified the components of the RMS that are within the scope of license renewal, as required by 10 CFR 54.4, and that the applicant has appropriately identified the components of the RMS that are subject to an aging management review, as required by 10 CFR 54.21(a)(1).

2.3.3.21 Evaluation Findings

On the basis of this review, the staff concludes that the applicant has adequately identified the auxiliary systems and components that are within the scope of license renewal, in accordance with the requirements of 10 CFR 54.4(a), and that the applicant has adequately identified the auxiliary system components that are subject to an aging management review, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.3.4 Steam and Power Conversion Systems

Steam and Power Conversion Systems (SPCS) act as a heat sink to remove heat from the reactor and convert the heat generated in the reactor to the plant's electrical output. The following systems are included in this subsection:

- feedwater
- auxiliary feedwater
- main steam and turbine steam extraction

During its review, the staff identified that the steam generator blowdown system is identified in LRA Section 3.4 as being included in the SPCS group. As shown above, the steam generator blowdown system is not part of the SPCS listed in this section. Additionally, LRA Table 2.2-1, "Plant Level Scoping Results," lists the steam generator feedwater blowdown system as being within the scope of license renewal. By letter dated October 11, 2002, the staff issued RAI 2.3.4-1 to obtain clarification from the applicant concerning where in the application the steam generator feedwater blowdown system is addressed. By letter dated December 19, 2002, the applicant stated that the steam generator blowdown system is within scope of license renewal as noted in LRA Table 2.2-1, and the system has been evaluated within other in-scope systems. The steam generator blowdown system component types subject to an AMR are included with the applicable component types listed in LRA Table 2.3.1.2-1, "Reactor Coolant" (includes SGs); LRA Table 2.3.2.2-1, "Containment Penetration and System Interface"; LRA Table 2.3.3.19-1, "Primary Sampling"; and LRA Table 2.3.4.1, "Feedwater." The staff determined that the applicant's response was acceptable because it clarified that the blowdown system is within scope and where the system components are located in the LRA.

2.3.4.1 Feedwater

2.3.4.1.1 Summary of Technical Information in the Application

The FW system consists of a supply line to each of the two SGs. An FW isolation valve in each SG supply line is located just outside the containment penetration. These valves are motor-operated, closing automatically on a steam generator isolation signal (SGIS). A check valve in each supply line, located inside containment, prevents uncontrolled blowdown from the affected SG in the event of an FW line break. The license renewal boundary also includes the piping from the SGs to the isolation valves for the blowdown and PS systems.

2.3.4.1.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.1 and USAR Section 10.2 to determine whether the FW system components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1).

In the performance of the review, the staff selected system functions described in the USAR that were required by 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted.

During its review, the staff identified numerous pressure and level transmitter housings shown on Drawing 11405-M-253, Sheet 1, that were in scope but were not subject to an AMR. From the drawing, it appeared the instrument housings formed part of a pressure boundary with their associated piping. Therefore, the staffed believed the instrument housings should be listed in LRA Table 2.3.4.1-1 as being subject to an AMR in accordance with 10 CFR 54.21. By letter dated October 11, 2002, the staff issued RAIs to obtain clarification from the applicant. By letter dated December 19, 2002, the applicant stated that the instruments do not require an AMR in accordance with guidance contained in Appendix B of NEI 95-10, Revision 3. However, the applicant's response did not address the instrument housings. Therefore, the staff found this response unacceptable. By letter dated February 20, 2003, the staff issued POI-4, requesting the applicant to address the instrument housings.

By letter dated March 14, 2003, the applicant responded to POI-4, stating that all housings of in-scope instruments that provide a pressure boundary function are included within scope and subject to an AMR in accordance with NEI-95-10. However, the staff reviewed a letter from Dennis Crutchfield (NRC) to Charles H. Cruse (Baltimore Gas and Electric Company [BGE]), "Final Safety Evaluation (FSE) Concerning the Baltimore Gas & Electric Company Report Entitled, 'Integrated Plant Assessment Methodology,'" dated April 4, 1996, which addressed, among other issues, the scoping and screening of instrumentation. In this letter, the staff stated that it "agrees with the BGE methodology to exclude "active" instrumentation such as water level transmitters, differential pressure transmitters, and pressure switches, from an aging management review. This is because 54.21(a)(1)(i) explicitly excludes pressure transmitters, pressure indicators, and water level indicators, as examples of "active" components which perform their intended functions with moving parts or with a change in configuration or properties, from an aging management review. In addition, the staff agrees with BGE that the pressure-retaining boundary of these "active" instrumentation is also excluded from an aging management review. This is because while 54.21(a)(1)(i) explicitly states that pumps and valves are excluded from an aging management review, with the explicit exception of their pressure-retaining boundary, no such exception is stated when excluding pressure transmitters, pressure indicators, and water level indicators from an aging management review.

"However, BGE methodology indicates that the pressure retaining boundary of "active" instrumentation is excluded from an aging management review in part because the instrumentation does not contribute significantly to a pressure retaining function. The staff believes that this BGE reasoning may not be entirely consistent with the intent of the final rule. The staff believes that the pressure retaining boundary of "active" instrumentation may be excluded from an aging management review because 'functional degradation resulting from the effects of aging on active components is more readily determinable, and existing programs and requirements are expected to directly detect the effects of aging.' (60 FR 22472) ""Active" instrumentation is sensitive equipment which is subject to extensive surveillance and testing. For example, technical specification surveillance programs will detect degradation of the passive, pressure retaining function of pressure transmitters from the effects of aging on the active function through response-time testing."

The staff has reviewed the April 6, 1996 letter and finds that, on the basis of its position regarding the treatment of the housings for "active" instrumentation, the instrument housings at FCS need not be subject to an AMR.

2.3.4.1.3 Conclusions

The staff reviewed the LRA and the accompanying scoping boundary drawings to determine whether any structures, systems, or components that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the applicant has appropriately identified the components of the FW system that are within the scope of license renewal, as required by 10 CFR 54.4, and that the applicant has appropriately identified the components of the FW system that are subject to an aging management review, as required by 10 CFR 54.21(a)(1).

2.3.4.2 Auxiliary Feedwater

2.3.4.2.1 Summary of Technical Information in the Application

The applicant describes the AFW system in LRA Section 2.3.4.2 and provides a list of components subject to an AMR in LRA Table 2.3.4.2-1.

The AFW system supplies feedwater to the SGs whenever the RCS temperature is above 300 °F and the main FW system is not in operation. The AFW system contains one emergency feedwater storage tank (EFWST) and two pumps, plus related piping, valves, and instrumentation. One pump is electric motor-driven, and the other is steam turbine-driven. The flow path connects to the AFW nozzles on the SGs. Either AFW pump can pump water from the EFWST to the SGs. In the event of automatic initiation, the AFW system is designed to automatically start both AFW pumps and direct flow to the SGs via the flow path to the AFW nozzles.

2.3.4.2.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.2 and USAR Section 9.4 to determine whether the AFW system components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1).

In the performance of the review, the staff selected system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted.

2.3.4.2.3 Conclusions

The staff reviewed the LRA and the accompanying scoping boundary drawings to determine whether any structures, systems, or components that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the applicant has adequately identified the components of the AFW system that are within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the components of the AFW system that are subject to an aging management review, as required by 10 CFR 54.21(a)(1).

2.3.4.3 Main Steam and Turbine Steam Extraction

2.3.4.3.1 Summary of Technical Information in the Application

The applicant describes the main steam and turbine steam extraction system in LRA Section 2.3.4.3 and provides a list of components subject to an AMR in LRA Table 2.3.4.3-1.

The portion of the main steam and turbine steam extraction system within the scope of license renewal consists of the piping from each SG which penetrates the containment (steam generators are discussed in LRA Section 2.3.1.2). The piping outside containment includes the main steam safety valves and the main steam isolation valves (MSIVs). Also included in the main steam system boundary is the piping to the steam-driven AFW pump and the associated drains and vents. The main steam check valves are the boundary valves for each of the individual lines, and the MSIV packing leakoff line isolation valve is the boundary after the leakoff piping connects into a common header.

2.3.4.3.2 Staff Evaluation

The staff reviewed LRA Section 2.3.4.3 and USAR Section 10.1 to determine whether the main steam and turbine steam extraction system components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1), respectively.

In the performance of the review, the staff selected system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted.

During its review, the staff required clarification of the drawings used by the applicant to show which main steam and turbine steam extraction system components are within the scope of license renewal. The staff noted that the turbine drive casing for the steam-driven AFW pump and numerous steam traps are within the scope of license renewal but are not listed in LRA Table 2.3.4.3-1 as being subject to an AMR. These components are passive and long-lived and therefore should be subject to an AMR. By letter dated October 11, 2002, the staff issued RAI 2.3.4.3-2 to obtain clarification from the applicant. By letter dated December 19, 2002, the applicant stated that the turbine casing for the steam-driven AFW pump has been included in the AFW system. The “Turbine Casing” component type is in LRA Table 2.3.4.2-1. The applicant also stated that steam traps are included in the valve component group and therefore are subject to an AMR. The staff determined that the applicant’s response was acceptable because it clarified that the components are subject to an AMR and identified where the components can be found in the LRA.

2.3.4.3.3 Conclusions

The staff reviewed the LRA and the accompanying scoping boundary drawings to determine whether any structures, systems, or components that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the applicant has appropriately identified the components of the main steam and turbine steam extraction system that are within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has appropriately identified the components of the main steam and turbine steam extraction system that are subject to an aging management review, as required by 10 CFR 54.21(a)(1).

2.3.4.4 Evaluation Findings

On the basis of this review, the staff concludes that the applicant has adequately identified the steam and power conversion systems and components that are within the scope of license renewal, in accordance with the requirements of 10 CFR 54.4(a), and that the applicant has adequately identified the steam and power conversion system components that are subject to an aging management review, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.4 Scoping and Screening Results: Structures

2.4.1 Containment

The FCS containment is a domed structure that houses the RV, RCS and supports, and other systems that interface with the RCS. The containment also houses a substantial amount of CQE and non-CQE mechanical and electrical equipment. The structures of the containment are divided into two classifications (i.e., containment structure and containment internal structures).

2.4.1.1 Summary of Technical Information in the Application

The applicant describes the containment structure in LRA Section 2.4.1 and provides a list of the structural components subject to an AMR in LRA Table 2.4.1-1. The design and analysis of the containment structure are described in Section 5 of the USAR.

The containment structure is composed of a cylindrical wall, domed roof, and a foundation mat that are seismic Class I reinforced concrete structures; the wall and roof are partially prestressed. The foundation mat is common to both the containment building and the auxiliary building that is supported on steel piles driven to bedrock. This foundation mat incorporates a depressed center portion for housing the reactor vessel. The interior surfaces of the containment, including wall, roof, and foundation, are lined with a ¼-in carbon steel liner to maintain a high degree of leak-tightness. The liner plate for the floor is placed on top of the foundation concrete pour and is covered with an additional concrete floor covering. The un-bonded tendons of the prestressed portion in the wall and roof are in conduits filled with waterproof grease. The tendon anchors are accessible for inspection, testing, and re-tensioning via the tendon access gallery located directly beneath the cylinder wall and at the dome roof. The applicant has determined that all the seismic Class I structures meet the intent of 10 CFR 54.4(a)(1) and are within the scope of license renewal.

The containment internal structures consist of several levels of compartments supported on the foundation mat by concrete columns. The internal structures are isolated from the containment shell by a shake space which also permits the distribution and dissipation of any internal differential pressure during postulated accident events. There are several compartments which house the mechanical equipment, including the steam generator and reactor coolant pump compartments, pressurizer compartment, and the reactor cavity. The reactor cavity, which serves as the primary shield wall, houses the reactor pressure vessel.

The applicant identified the following intended functions for the containment structure and its internal structures that fall within the scope of license renewal:

- serve as a pressure boundary or a fission-product retention barrier to protect public health and safety during a DBE
- provide shelter/protection to safety-related equipment
- provide structural and functional support to safety-related equipment
- provide structural support to non-safety-related components whose failure could prevent satisfactory accomplishment of any of the required safety equipment functions
- serve as a missile barrier (internal or external)
- provide flood protection barrier (internal and external flooding event)
- provide shielding against radiation and high-energy line breaks
- provide rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant
- provide spray shield or curbs for directing flow (e.g., safety injection flow to containment sump)

The boundary of the containment in scope includes all the concrete, steel, elastomer, and fire barrier components of the containment internals and the domed roof and cylinder wall of the containment building. The containment structure also includes any components attached to the outside of the cylinder wall or dome above the auxiliary building roof. Various penetrations through the containment cylindrical wall are provided for the passage of piping and electrical conduits. The pipe sleeves, welds between the sleeve and the liner of the mechanical and electrical penetrations, and welds between the sleeve and the penetration are included in the boundary of the containment structure. The component supports (e.g., pipe supports, cable tray supports, equipment supports, and associated anchorage), fuel-handling equipment, heavy load cranes, and building piles are evaluated as the commodities in LRA Section 2.4.2, “Other Structures.”

In LRA Table 2.4.1-1, the applicant lists 20 structural component types and their intended functions for the containment structure and its internal structures as the result of aging management review. The components listed in the table meet the scoping criteria of 10 CFR 54.4(a) because they perform one or more of the intended functions specified in the table. They also meet the screening criteria of 10 CFR 54.21(a)(1) because they are passive and perform applicable intended functions without moving parts or without a change of configuration or properties, and they are not replaced based on a qualified life or specified time period.

2.4.1.2 Staff Evaluation

The staff reviewed the information in the LRA and the USAR to determine whether the containment structural components within the scope of license renewal and subject to an AMR have been identified in accordance with the requirements of 10 CFR 54.4 and 54.21(a)(1), respectively. After completing its initial review, the staff issued RAIs for the containment and other structures in a letter to the applicant, dated October 11, 2002. The applicant responded to the staff’s RAIs in letters to the NRC, dated November 22 and December 19, 2002.

The staff reviewed the scoping results in LRA Section 2.4.1, supporting information in USAR Section 5 (i.e., 5.1, 5.4, 5.5, 5.6, and 5.9), and the additional information submitted by the applicant in response to the staff's RAIs to determine if there were any structures or components within the containment boundary that the applicant did not identify as being within the scope of license renewal or as being subject to an AMR. On the basis of this review, the staff has made the findings described below.

LRA Section 2.4.1 states that the tendon anchors are accessible for inspection, testing, and retensioning via the tendon access gallery located beneath the containment cylindrical wall and the dome roof. LRA Table 2.4.1-1 lists all the components for the containment structure and its internal structures that are subject to an AMR. However, the tendon access galleries are not included in the table. In RAI 2.4.1-1, the staff asked the applicant whether the concrete structures of the tendon access galleries are in scope and subject to an AMR for license renewal.

In its response, the applicant stated that the function of the tendon gallery is to provide access to the tendon anchorage for inspection and testing. The concrete structures of the tendon galleries are not in scope for license renewal because they do not make up part of the containment pressure boundary nor provide support for the containment. However, the concrete where the tendons are anchored in the tendon gallery is within the scope of license renewal. The staff agrees with the applicant's justification that the tendon access gallery does not have to be in scope because it does not perform a containment pressure boundary function to prevent or mitigate the consequences of an accident that could result in potential offsite exposure or any other functions under 10 CFR 54.4.

LRA Table 2.4.1-1 lists the containment equipment access hatch and personnel airlock as the components of the containment structure subject to an AMR. However, the applicant did not identify whether certain operable parts of the airlock require an AMR. In RAI 2.4.1-2, the staff requested the applicant to verify whether the airlock-door interlock system, equalizing valves, door seals, and operation mechanism (such as gears, latches, hinges, etc.) are in scope and subject to an AMR for license renewal.

In its response, dated December 19, 2002, the applicant stated that the containment equipment hatch consists of a bolted-door and a gasket. These parts are passive and long-lived components and are subject to an AMR. The containment personnel airlock interlock system, which is required to keep the door air-tight (door and seal) and in a closed position (latches), is within the scope of license renewal. The latches and door are the passive and long-lived components and therefore are subject to an AMR. The airlock seal is periodically replaced and is not subject to an AMR. The gears, equalizing valves, and hinges are the active components. They are not subject to an AMR.

The staff reviewed the RAI response in which the applicant identified certain active components that perform a passive function associated with maintaining the airlock in the closed position while others (e.g., gears, equalizing valves, and hinges) do not maintain the air lock in the closed position. However, the applicant did not explain how the periodic replacement of the airlock seal is performed. In POI-5(a), issued on February 20, 2003, the staff requested the applicant to explain (1) how often the airlock seal should be replaced and (2) how often the airlock seal is inspected.

In its response, dated March 14, 2003, the applicant stated that gaskets, O-rings, etc., are considered consumables and are not subject to AMR as per NEI 95-10, Revision 3. The periodic surveillance and preventive maintenance program (PS/PMP) performs periodic inspections and maintenance of containment personnel airlocks. The procedure is performed on one door (alternating inner/outer door) at each refueling outage. The applicable (inner or outer) door is inspected, and the seals are replaced during each performance of the procedure.

The staff agrees with the functions and scoping of these operable parts as the applicant described. The staff also confirmed that the airlock seals are inspected and replaced periodically under the specified program (PS/PMP). Therefore, the staff found that the applicant's responses to RAI 2.4.1-2 and POI-5(a) are acceptable.

LRA Table 2.4.1-1 lists "containment concrete above grade," "containment concrete below grade," and "containment concrete in ambient air" as the component types to represent all the concrete components subject to an AMR in the containment. It is not clear from the information in the submittal which structural components are included in these groups. In RAI 2.4.1-3, the staff requested the applicant to (1) identify which reinforced concrete structures are included in each component group and (2) explain whether the refueling cavity walls, containment sumps, and missile shields are included in any of these component groups.

In its response, the applicant stated that the "concrete above grade" consists of the containment dome and cylindrical walls that are exposed to the weather. The "concrete below grade" consists of the foundation mat and the portion of the cylindrical walls that are below grade. The "containment concrete in ambient air" consists of all interior containment structures (e.g., reactor cavity, floors, and missile shields), the portion of the containment cylindrical walls which are protected from weather by the auxiliary building, and the inside of the containment dome and cylindrical walls. The refueling cavity walls, containment sumps, and missile shields are also included in the component type "Containment Concrete in Ambient Air." The staff found that the applicant's response clarifies the concrete components of the containment.

LRA Table 2.4.1-1 uses the component type "Containment Structural Steel in Ambient Air" to represent all the steel structures subject to an AMR in the containment. It is not clear from the information provided which structures are included in these component groups. In RAI 2.4.1-4, the staff asked the applicant to identify which steel structures and components in the containment are subject to an AMR.

In its response, the applicant stated that the component type "containment structural steel in ambient air" includes columns/posts, beams, base-plates, bracing, crane girders, platform hangers, checkered plate, decking, grating, stairs, ladders, ladder cages, whip restraints, pipe rupture shields, radiant energy shields, exposed faces of embedded plates/structural shapes, and the external reinforcement of the masonry walls. The applicant stated that all of these components are within the scope of license renewal and subject to an AMR. The staff found that the applicant's response clarifies the scoping process for the structural steel components.

LRA Table 2.4.1-1 lists the fuel transfer penetration as a containment component subject to an AMR. The staff believes that the components within the fuel transfer penetration, such as fuel transfer tubes, expansion bellows, and flange supports, are passive and long-lived components and therefore should be subject to an AMR. In RAI 2.4.1-5, the staff asked the applicant whether these components are subject to an AMR. The applicant responded that the fuel transfer tubes, expansion bellows, and flange supports are included in LRA Table 2.4.2.5-1. They are in scope and subject to an AMR for license renewal. The staff found that the applicant's response clarifies the component scoping of the fuel transfer penetration.

LRA Section 2.4.1 does not address the polar crane, jib cranes, and their supports. LRA Table 2.4.1-1 does not list any of their components. In RAI 2.4.1-6, the staff asked the applicant whether the main girders, runway rails, runway rail brackets, rail anchorages, and embedment that support the polar crane are within the scope of license renewal and, if so, where in the LRA they are discussed. If not, the staff asked the applicant to justify not including them within the scope of license renewal.

In its response, the applicant stated that the cranes are in scope and subject to an AMR for license renewal. These cranes are discussed in LRA Section 2.4.2.5, "Fuel Handling Equipment and Heavy Load Cranes," and their components are listed in LRA Table 2.4.2.5-1. The passive and long-lived subcomponents of the containment cranes in scope include crane/trolley rail systems, hoist monorails, and structural members used for the support of the crane bridge and trolley. The component types in LRA Table 2.4.2.5-1 associated with cranes or similar lifting devices represent only those subcomponents that are within the scope of license renewal and subject to AMR. All other subcomponents are considered to be active or have no intended function and therefore are not within the scope of license renewal. The components not in scope include brakes, antennas, motors, wheels, gears, shafts, cables, control panels, and junction boxes. The staff found that the applicant has clarified the scoping process of the components for the cranes and lifting devices in the containment.

USAR Section 5.11 states that special steel structures are used around the steam generators for the purpose of limiting the motion of the steam generator in case a rupture occurs in the reactor coolant piping, main steam piping, or the feedwater piping. These special steel structures are not addressed in LRA Section 2.4.1. The staff believes that these passive and long-lived structures perform an intended function to ensure the functionality of the steam generators and therefore should be in scope and subject to AMR for license renewal. In RAI 2.4.1-7, the staff requested the applicant to clarify whether the components addressed in USAR Section 5.11 are within the scope of license renewal or to justify their exclusion.

In its response, the applicant stated that these special structures are the cradle assemblies that support the steam generators. They are in scope and subject to an AMR for license renewal. They are included in LRA Table 2.4.2.6-1 as the component type "Component Support Weathering Carbon Steel in Ambient Air." These assemblies are shown in Drawings E-23866-321-020 and E-23866-321-210. The staff found that the applicant has included these components in scope, and therefore its response is acceptable.

The staff has reviewed the above information and LRA Table 2.4.1-1 and did not identify any omissions by the applicant relating to scoping and screening of the containment structure and its internal structures and components. The staff also found that all the passive structures and components identified as being within the scope of license renewal were subject to an AMR.

2.4.1.3 Conclusions

The staff reviewed the LRA to determine whether any structures and components that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the applicant has adequately identified the structural components of the containment and the internal structures that are within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the structural components of the containment and the internal structures that are subject to an aging management review, as required by 54.21(a)(1).

2.4.2 Other Structures

Other structures which require license renewal are the passive and long-lived structures other than the containment structure. In LRA Section 2.4.2, "Other Structures," the applicant determined that the following seismic Class I structures are included in the group of other structures for license renewal:

- auxiliary building
- turbine building and service building
- intake structure
- building pile
- fuel handling equipment and heavy load cranes.
- component supports
- duct banks

2.4.2.1 Auxiliary Building

2.4.2.1.1 Summary of Technical Information in the Application

The applicant describes the structures in the boundary of the auxiliary building in LRA Section 2.4.2.1 and provides a list of components in LRA Table 2.4.2.1-1. The design of the auxiliary building structure is further described in USAR Section 5.11.4.

The auxiliary building is a seismic Class I structure that houses the safety-related systems, structures, and components that support normal operation, shutdown, and accident conditions. Seismic Class I structures meet the intent of 10 CFR 54.4(a) because they are designed to prevent uncontrolled release of radioactivity and to withstand system and seismic loading without loss of function. The auxiliary building is a multi-floored reinforced concrete structure supported by a mat foundation which is shared with the containment building. The building structure is of box-type construction with interior bracing provided by vertical concrete walls and horizontal floor slabs. The mat foundation is supported on steel piles driven to the bedrock. The spent fuel pool is in the auxiliary building and is a seismic Class I reinforced concrete structure. The inside face of the pool has a stainless steel liner. The masonry walls in the area of safety-related equipment are steel reinforced to provide protection for the safety-related components and equipment located nearby.

In LRA Table 2.4.2.1-1, the applicant lists the passive structural components and their intended functions for the auxiliary building. These components listed in the table meet the scoping criteria because they perform one or more of the intended functions specified in the table. They also meet the screening criteria for an AMR because they perform their intended functions without moving parts or without a change in configuration or properties and are not subject to periodic replacement based on qualified life or specified time period.

2.4.2.1.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.1 and USAR Section 5.11.4 to determine whether the structural components and commodities of the auxiliary building within the scope of license renewal and subject to an AMR have been properly identified in accordance with 10 CFR 54.4 and 10 CFR 54.21(a)(1), respectively.

In performing this review, the staff selected the system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted.

The applicant listed 18 structural component types in LRA Table 2.4.2.1-1. These component types represent the groups of the structural components subject to an AMR based on their operating environment and construction materials. These component types include concrete in ambient air, structural steel, missile shields, carbon steel expansion/grout anchors, carbon steel threaded fasteners, etc. Some of the component types listed in the table are unique, such as safety injection and refueling water tank foundation, diesel fuel oil tank foundation, auxiliary building pyrocrete (fire barrier), and spent fuel pool liner.

LRA Section 2.4.2.2 states that the spent fuel pool (SFP), which consists of a stainless-steel-lined concrete structure, is contained within the auxiliary building. However, LRA Table 2.4.2.1-1 lists only the spent fuel pool liner as the component subject to an AMR. The staff believed that other components of the SFP structure meeting the 10 CFR 54.4 criteria should also be included within the scope of license renewal and be subject to an AMR. In RAI 2.4.2.1-1, the staff requested the applicant to verify what other component types listed in LRA Table 2.4.2.1-1 (or in other tables) are applicable to the spent fuel pool structure.

In its response, the applicant stated that the spent fuel pool concrete is included in LRA Table 2.4.2.1-1, “Auxiliary Building,” in the component type “Auxiliary Building Concrete in Ambient Air.” The spent fuel racks are included in the component type “Spent Fuel Storage Racks” in LRA Table 2.4.2.5-1, “Fuel Handling Equipment and Heavy Load Cranes.” The table also lists the component types “Fuel Transfer Conveyor” and “Fuel Transfer Carrier Box.” The applicant previously responded to RAI 2.4.1-5 for the fuel transfer penetration in the containment (and was found acceptable). The staff’s review of the information provided in response to RAIs 2.4.2.1-1 and 2.4.2.5-1 found that the applicant has identified the components in the spent fuel pool structure other than the SFP liner, and specified the LRA tables that contain these components. Therefore, the staff found no omissions in the scoping and screening of the SFP components.

The staff has reviewed the information in LRA Section 2.4.2.1, the USAR, and the additional information submitted by the applicant in response to the staff’s RAI. The staff finds that the applicant made no omissions in scoping the auxiliary building structures and components for license renewal. The staff’s review also found that all the passive structures and components identified as being within the scope of license renewal were subject to an AMR.

2.4.2.1.3 Conclusions

The staff reviewed the LRA to determine whether any structures, systems, or components that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the applicant has adequately identified the structural components of the auxiliary building that are within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the structural components of the auxiliary building that are subject to an aging management review, as required by 10 CFR 54.21(a)(1).

2.4.2.2 Turbine Building and Service Building

2.4.2.2.1 Summary of Technical Information in the Application

The applicant describes the turbine building and service building in LRA Section 2.4.2.2 and provides a list of their components subject to an AMR in LRA Table 2.4.2.2-1. The design of the turbine building and service building is further described in USAR Section 5.11.

The turbine building and service building are seismic Class II structures that house both limited CQE and non-CQE systems and components. The turbine building also houses the restraints and shields which protect systems and equipment from main steam and feedwater high-energy line breaks. The CQE component (valve HCV-2861) for the raw water system is located in the basement of the service building. From the basement to the operating floor, the turbine building is a box-type reinforced concrete structure supported on a mat foundation. The mat foundation is supported on steel piles driven to bedrock. From the operating floor to roof, the turbine building is a braced steel frame structure clad with aggregate resin panels. The multi-layered built up roof is supported by metal decking spanning between open web steel joists.

The service building is a multi-floored braced steel frame structure clad with aggregate resin panels. The multi-layered built up roof is supported by metal decking spanning between open web steel joists. The building is founded on the mat foundation which is supported on steel piles driven to bedrock.

The turbine pedestal on the operating floor is independent from the turbine building structure that is included in the system boundary. The component supports (e.g., pipe supports, cable tray supports, conduit supports, equipment supports, and equipment anchorage) in the turbine building and service building are evaluated as the commodities in LRA Section 2.4.2.6, “Component Supports.” The steel piles are evaluated as a unique commodity in LRA Section 2.4.2.4, “Building Piles.”

In LRA Table 2.4.2.2-1, the applicant lists eight structural component types and their intended functions for the turbine building and service building. These components listed in the table meet the scoping criteria because they perform one or more of the intended functions specified in the table. They also meet the screening criteria for an AMR because they are passive and perform their intended functions without moving parts or without a change in configuration or properties, and are not subject to periodic replacement based on qualified life or specified time period.

2.4.2.2.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.2 and USAR Section 5.11 to determine whether the structural components of the turbine building and service building within the scope of license renewal and subject to an AMR have been identified in accordance with the requirements of 10 CFR 54.4 and 54.21(a)(1), respectively.

In the performance of this review, the staff selected the system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that the components having intended functions were not omitted from the scope of the Rule. The staff also focused on the components that were not identified as being subject to an AMR to determine if any of the components were omitted.

LRA Section 2.4.2.2 describes the turbine building and service building. LRA Table 2.4.2.2-1 lists the component types that have the intended functions to act as structural support to non-CQE pipe restraints and high-energy line break (HELB) shielding. It is not clear from the information provided which portions of the buildings are in scope and which components perform these intended functions. In RAI 2.4.2.2-1, the staff asked the applicant to specify the structural components of the turbine building and service building that are within the scope of license renewal and subject to an AMR.

In its response, the applicant stated that the intended function of providing “pipe whipping restraint” is fulfilled by the main steam and feedwater pipe whip restraints for the HELB analysis. The intended function of providing “shielding against HELB” is fulfilled by the steel plates attached to or adjacent to the turbine building side of the auxiliary building wall. The intended function of providing “structural support to non-safety-related components whose failure could prevent satisfactory accomplishment of any of the required safety-related functions” is fulfilled by the concrete and structural steel of the turbine building and service building. The turbine building concrete and structural steel provide support for the pipe restraints and HELB shielding. The service building concrete and structural steel support a CQE component (valve HCV-2861 in the service building basement) for the raw water system.

The staff has reviewed the information in LRA Section 2.4.2.2, the USAR, and the additional information submitted by the applicant in response to the staff’s RAI. The staff finds that the applicant made no omissions in scoping the structures and components of the turbine building and service building for license renewal. The staff’s review also finds that all the passive structures and components identified as being within the scope of license renewal were subject to an AMR.

2.4.2.2.3 Conclusions

The staff reviewed the LRA to determine whether any structures, systems, or components that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the applicant has adequately identified the structural components of the turbine building and service building that are within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the structural components of the turbine building and service building that are subject to an aging management review, as required by 10 CFR 54.21(a)(1).

2.4.2.3 Intake Structure

2.4.2.3.1 Summary of Technical Information in the Application

The applicant describes the intake structure in LRA Section 2.4.2.3 and provides a list of structural components subject to an AMR in LRA Table 2.4.2.3-1.

The intake structure houses and protects both CQE and non-CQE systems and components. The diesel-driven fire pump fuel tank enclosure is also included in the intake structure. The intake structure is a multi-floored seismic Class I structure. From the foundation mat to 7 feet above the operating floor, the intake structure is a box-type reinforced concrete structure with internal bracing provided by concrete walls and floor slabs. The mat foundation is supported on steel piles driven to bedrock. Above the operating floor level to the roof, the structure is a braced steel frame clad with aggregate resin panels. The multi-layered built up roof is supported by metal decking spanning between open web steel joists.

In LRA Table 2.4.2.3-1, the applicant lists 19 component types and their intended functions for the intake structure as the result of aging management review. These component types include concrete below grade, concrete exposed to raw water, concrete exterior in ambient air, concrete interior, structural steel in ambient air, stainless steel threaded fasteners, rubber components in flood barriers, fire protection pyrocrete, flood panel seals, grout protected from weather, cast iron stuffing box floor penetration, carbon steel pipe and pipe casing, intake structure stainless steel raw water pump gland bolting, stainless steel strainer backwash piping floor penetration, sand and gravel surrounding the diesel fire pump fuel oil storage tank, gland and gland bolting, carbon steel expansion/grouted anchors, carbon steel pipe sleeve and flange floor penetration, and carbon steel threaded fasteners inside building. These components meet the scoping criteria because they perform one or more of the intended functions specified in the table. They also meet the screening criteria for an AMR because they are passive and perform their intended functions without moving parts or without a change in configuration or properties, and they are not subject to periodic replacement based on qualified life or specified time period.

Certain components within the intake structure are not included in this table, but they are subject to an AMR. The steel piles are evaluated as a unique commodity in LRA Section 2.4.2.4, “Building Piles.” The fuel-handling equipment and heavy load cranes are evaluated in LRA Section 2.4.2.5, “Fuel Handling Equipment and Heavy Load Cranes.” The pipe supports, cable tray supports, equipment supports, and associated anchorage are evaluated in LRA Section 2.4.2.6, “Component Supports.” The cover and flange of manhole MH-31, its elastomer joint and frame, and the foam blocks inside the manhole are evaluated in LRA Section 2.4.2.7, “Duct Banks.”

2.4.2.3.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.3 and LRA Table 2.4.2.3-1 to determine whether the structural components of the intake structure within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1), respectively.

In performing this review, the staff selected the system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that the components having intended functions were not omitted from the scope of the rule. The staff also focused on the components that were not identified as being subject to an AMR to determine if any of these components were omitted.

LRA Section 2.4.2.3 states that the intake structure is a multi-floored seismic Class I structure that houses both the CQE and non-CQE systems and components and the fuel tank of the diesel-driven fire pumps. However, most of the component types listed in LRA Table 2.4.2.3-1 are not addressed in LRA Section 2.4.2.3. There are no structural drawings in the LRA that can be used to check if anything is missing. In RAI 2.4.2.3-1, the staff requested the applicant to provide additional information on the components and equipment supports within the intake structure that are subject to an AMR.

In its response, the applicant stated that all components and equipment supports are included in LRA Section 2.4.2.6, because the operating floor of the intake structure is designed to remain functional after a crane load drop. The bridge crane does not have an intended function per 10 CFR 54.4. The cable trenches in the concrete slabs are included in the component type "Concrete in Ambient Air." The conduits embedded in the concrete are included in the concrete structure (similar to the reinforcing steel in concrete). The hatches are included in the component type "Structural Steel in Ambient Air." The only missile barrier for the intake structure is the operating floor slab, which is included in the component type "Concrete in Ambient Air."

In POI-3(a), the staff requested the applicant to justify why the circulating water system should not be in scope. In its response by letter dated March 14, 2003, the applicant stated that the circulating water discharge tunnel will be included within the scope of license renewal as part of the intake structure because its aging may affect the raw water discharge. The component types "carbon steel pipe sleeve and flange floor penetration," "concrete below grade," and "concrete exposed to raw water" as listed in LRA Table 2.4.2.3-1, will represent the components of the circulating water discharge tunnel subject to an AMR. The discharge tunnel was not discussed in LRA Section 2.4.2.3. The applicant added the structure of the discharge tunnel to its scoping boundary of the intake structure because of the raw water system function. Based on the applicant's response to POI-3(a), the staff found that adding the circulating water discharge tunnel to the license renewal boundary of the intake structure is justified and acceptable.

The staff has reviewed the information in LRA Section 2.4.2.3 and the additional information submitted by the applicant in response to the staff's RAI. On the basis of its review, the staff found that the applicant had omitted the circulating water discharge tunnel from the scope of license renewal. The tunnel was subsequently brought into scope. The staff reviewed the remainder of the intake structure and components and found no other omissions. On the basis of its review, including the identification of additional systems and components brought into scope, the staff concludes that all systems, structures, and components within the scope of license renewal have been identified, in accordance with the requirements of 10 CFR 54.4. The staff also finds that all the passive structures and components identified as being within the scope of license renewal were subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2.3.3 Conclusions

The staff reviewed the LRA to determine whether any structures, systems, and components that should be within the scope of license renewal were not identified by the applicant. With the exception of the circulating water discharge tunnel, no omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the structural components of the intake structure that are within the scope of license renewal have been identified, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the structural components of the intake structure that are subject to an aging management review, as required by 10 CFR 54.21(a)(1).

2.4.2.4 Building Piles

2.4.2.4.1 Summary of Technical Information in the Application

The applicant describes the building piles in LRA Section 2.4.2.4 and provides a list of the components subject to an AMR in LRA Table 2.4.2.4-1. The building piles are further described in USAR Section 5.7.

The building piles are a unique commodity that consists of four types of piles: Class A steel pipe piles, Class B steel pipe piles, concrete caissons, and steel H-piles.

Class A piles are the 20-in outside-diameter (OD) open-end steel pipe piles with 1.031-in thick walls driven to bedrock. The piles are filled with sand to the point 4 ft below the top of the pile. The remaining top 4 ft is filled with concrete. The Class A piles are capped with a 2-in thick steel plate end closure. The seismic Class I structures (e.g., containment, auxiliary building, and intake structure) are founded on the Class A piles. The Class A piles are also used to support the turbine generator foundation located in the turbine building.

Class B piles are the12.75-in OD closed-end steel pipe piles with 0.25-in thick walls and filled with concrete. The Class B piles are capped with a 1.25-in steel plate end closure. Seismic Class II structures (e.g., the turbine building and service building) are founded on the Class B piles driven to bedrock.

Concrete caissons are the 3-ft diameter reinforced concrete cylinders that extend 10 ft into bedrock. They are used to support the diesel generator missile-shield enclosure.

Steel H-piles are used in the foundations of yard structures to support the transformers, the condensate storage tank (DW-48), the auxiliary boiler fuel oil storage tank (FO-10), and the diesel engine fuel oil storage tank (FO-1). The applicant determined that only the H-piles used in the foundation of the diesel engine fuel oil storage tank have an intended function and are within the scope of license renewal.

In LRA Table 2.4.2.4-1, the applicant lists the passive structural components and their intended functions for the building piles. The components listed in the table meet the scoping criteria because they perform an intended function to support structures. They also meet the screening criteria for an AMR, because they perform the intended function without moving parts or without a change in configuration or properties and are not subject to periodic replacement based on qualified life or specified time period.

2.4.2.4.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.4 and USAR Section 5.7 to determine whether the structural components of the building piles within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1), respectively.

In the performance of this review, the staff selected the system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that the components having intended functions were not omitted from the scope of the rule. The staff also focused on the components that were not identified as being subject to an AMR to determine if any of these components were omitted.

LRA Table 2.4.2.4-1 lists five component types subject to an AMR, including Class A pipe piles, Class B pipe piles, Class B pipe pile concrete, concrete caissons, and steel H-piles. The steel plate end closures used to cap the Class A and Class B steel pipe piles are not included in the table. The staff's review found that these steel-plate closures capped the pile heads after they were driven into the ground and became part of the piles. However, the table listed Class B pipe pile concrete as the component subject to AMR, but Class A pipe pile concrete was not listed. The staff found that the top 4 ft of the Class A pipe pile was filled with concrete after the pile was driven into the ground. The open-end pipe piles are designed to support the seismic Class I structures. The concrete in the Class A pipe piles does not have the function to support structures but to make the pile solid for preventing lateral buckling. Therefore, the staff found no omissions in the component screening process.

In the LRA, the applicant stated that the steel H-piles are used in the foundations of yard structures to support the transformers, the condensate storage tank (DW-48), the auxiliary boiler fuel oil storage tank (FO-10), and the diesel engine fuel oil storage tank (FO-1). The applicant determined that only the H-piles used in the foundation of the diesel engine fuel oil storage tank have an intended function and are within the scope of license renewal. However, during the scoping and screening inspection in November 2002, the staff reviewed the boundaries of the auxiliary building depicted in the applicant's license renewal drawings and found that FO-10 is also used to maintain the technical specification-required amount of fuel oil. FO-10 is credited in Technical Specification Amendment 162, dated March 29, 1994, as having 8000 gallons of fuel oil that could be transferred to FO-1, and that this was necessary for the EDGs to have the required amount of fuel oil. The amount of fuel in FO-10, combined with the amount of fuel in FO-1, provides for about 7 days of diesel operation. FO-1 and FO-10 are almost identical in their design details.

The applicant had placed FO-10 within scope, but only as a 10 CFR 54.4(a)(3) item for SBO reasons. Therefore, the foundation of FO-10 would not be within scope. The inspection team determined that, since both tanks were noted in the safety evaluation associated with Technical Specification 162 as required to store the amount of fuel oil required for the EDGs to perform their design basis function, FO-10 should have been placed within scope per 10 CFR 54.4(a)(2). The applicant reviewed this item and agreed with the inspection team that the tank foundation should be included within the scope of license renewal. Inclusion of the FO-10 foundation did not result in any revisions to the applicant's evaluation results for the building piles because the piles used for the foundation of FO-10 are of the same type as those for FO-1. On this basis, the staff concludes that inclusion of the FO-10 foundation and its associated building piles within the scope of license renewal and subject to an AMR is appropriate and acceptable. A discussion of the FO-10 foundation can be found in the staff's scoping and screening inspection report (NRC Inspection Report Number 50-285/02-07).

The inspection team reviewed the remaining tank foundations and the associated piles and found no additional foundations or piles that should have been brought into scope.

The staff has reviewed the LRA and support information in the USAR to determine whether the applicant properly identified the components that are within the scope of license renewal and subject to an AMR. The staff finds that, although the foundation for FO-10 was brought into scope, it did not affect the applicant's evaluation for the building piles. On this basis, the staff finds the applicant identified all the building piles within the scope of license renewal. The staff also finds that all the passive components identified as being within the scope of license renewal were subject to an AMR.

2.4.2.4.3 Conclusions

The staff reviewed the LRA to determine whether any structures, systems, or components that should be within the scope of license renewal were not identified by the applicant. Although the foundation for FO-10 was brought into scope, it did not affect the applicant's evaluation for the building piles. On this basis, the staff concludes that no omissions were found. In addition, the staff performed an independent assessment to determine whether any building piles that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the applicant has adequately identified the structural components of the building piles that are within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the components of the building piles that are subject to an aging management review, as required by 10 CFR 54.21(a)(1).

2.4.2.5 Fuel-Handling Equipment and Heavy Load Cranes

2.4.2.5.1 Summary of Technical Information in the Application

The applicant describes the fuel-handling equipment and heavy load cranes in LRA Section 2.4.2.5 and provides a list of components subject to an AMR in LRA Table 2.4.2.5-1. Additional information concerning fuel-handling systems and cranes is given in Section 9.5 of the FCS USAR.

In Section 2.1 of the LRA, the applicant describes its process for identifying structures within the scope of license renewal and subject to an AMR. Based on its methodology, the applicant, in LRA Table 2.2-1, identifies the fuel-handling system and heavy load cranes within the scope of license renewal and describes the results of its scoping methodology in Section 2.4.2.5 of the LRA.

This commodity includes all components used in the storage and handling of new/spent fuel and in the hoisting of loads. The fuel-handling portion of this commodity consists of the refueling machine, tilting machines in containment and auxiliary building, fuel transfer conveyor, fuel transfer carrier box, fuel transfer tube, new and spent fuel-handling tools, new and spent fuel storage racks, and spent fuel bridge. The heavy load cranes portion consists of eight cranes of varying types (e.g., overhead crane, hoist with monorail, and jib crane).

The applicant identified component types for the fuel-handling equipment and heavy load cranes that are subject to an AMR in Table 2.4.2.5-1 of the LRA. This table lists the component types with their passive function identified and a link to their AMR results. The applicant identified the following component groups for the fuel-handling equipment and heavy load cranes that are subject to an AMR: concrete slab removal cranes, containment crane, containment equipment hatch crane and jib, deborating demineralizing area crane, fuel transfer conveyor, fuel transfer carrier box, fuel transfer tube, new and spent fuel handling tools, new fuel storage racks, tilting machines, upper guide lift rig, waste evaporator equipment handling crane, and the reactor vessel closure head lift rig.

In LRA Table 2.4.2.5-1, the applicant lists the component types that are within the scope of license renewal because they are passive and long-lived and perform a structural support intended function for non-CQE SSCs.

2.4.2.5.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.5 and USAR Sections 9.5 and 14.14 to determine whether the fuel-handling equipment and heavy load crane components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1), respectively.

In the performance of the review, the staff selected system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted. This was accomplished as described below.

The staff reviewed the structural component types in LRA Table 2.4.2.5-1 to determine whether any other fuel-handling equipment or heavy load cranes meet the scoping criteria of 10 CFR 54.4(a) but were not included within the scope of license renewal. The staff then reviewed portions of the USAR descriptions to ensure that all SCs of the fuel-handling equipment and heavy load cranes had been adequately identified and that they were passive, long-lived, and performed their intended functions without moving parts or without a change in configuration or properties and were not subject to replacement based on qualified life or specified time period. The staff also examined the component types listed in Table 2.4.2.5-1 of the LRA to determine whether they are the only groups subject to an AMR in accordance with 10 CFR 54.21(a)(1).

In a letter dated October 11, 2002, the staff requested additional information from the applicant regarding the component types listed in Table 2.4.2.5-1 of the LRA. In RAI 2.4.2.5-1, the staff stated that the applicant had not identified and listed the structures and components of the various cranes in accordance with 10 CFR 54.21(a)(1). Instead, LRA Table 2.4.2.5-1 lists those crane systems that are within the scope of license renewal. Although the crane systems listed in LRA Table 2.4.2.5-1 meet the scoping criteria of 10 CFR 54.4(a), the applicant did not list crane SCs subject to an aging management review. Moreover, SCs such as beams, supporting columns, base plates, rails, rail clips, crane girders, structural steel members, rail bolts, baseplates and anchors for attachments to structures, and retaining clips should be listed in LRA Table 2.4.2.5-1 as subject to an AMR.

In a letter dated December 19, 2002, in response to RAI 2.4.2.5-1, the applicant stated that since the aging management of cranes is consistent with the GALL Report, which does not provide a detailed listing of crane/lifting device subcomponents, the applicant did not deem it necessary to list subcomponents in LRA Table 2.4.2.5-1. The GALL Report does not address scoping of structures and components for license renewal. Scoping is plant specific, and the results depend on plant design and current licensing basis. The GALL Report states that “the inclusion of a certain structure or component in the GALL Report does not mean that the particular structure or component is within the scope of license renewal for all plants. Conversely, the omission of a certain structure or component in the GALL Report does not mean that the particular structure or component is not within the scope of license renewal for any plants.” In essence, the GALL Report is not applicable to plant scoping for license renewal, although, certain structures and components evaluated within the GALL Report may be within the scope of license renewal for a specific plant.

The applicant’s letter of December 19, 2002, in response to RAI 2.4.2.5-1, did not identify and list the structures and components subject to an AMR in accordance with 10 CFR 54.21(a)(1). Therefore, the SCs for the fuel-handling equipment and heavy load cranes have not been identified and listed in LRA Table 2.4.2.5-1 in such manner to allow the staff to determine that all of the SCs have been included within the scope of license renewal. By letter dated February 20, 2003, the staff issued POI-5(b), requesting the applicant to provide a list of the SCs for the fuel-handling equipment and heavy load cranes.

By letter dated March 14, 2003, the applicant responded to POI-5(b) by noting that the last paragraph of the response to RAI 2.4.2.5-1 includes the subcomponent breakdown used for FCS scoping and screening. Each of the cranes, lift rigs, etc., includes the entire device from the lifting apparatus to the structural supports used to mount the crane to the structure. The mounting bolting is included in the component supports commodity.

The staff reviewed the applicant’s response to POI-5(b) and finds that the response, along with the response to RAI 2.4.2.5-1, demonstrates that the applicant has identified all components in the fuel-handling equipment and heavy load cranes system that are within scope and subject to an AMR. POI-5(b) is resolved.

Also, in the December 19, 2002, letter, the applicant provided its response to RAI 2.4.2.5-2. In RAI 2.4.2.5-2, the staff stated that the boral panels protected with stainless steel, which are attached to the spent fuel pool storage racks, support the prevention of criticality, in the spent fuel pool. As such, they perform an intended function of preventing criticality and they should be included within the scope of license renewal and subject to an AMR. In addition, LRA Table 2.4.2.5-1 should be revised to include the boral panels and their stainless steel covering. The applicant in the RAI response indicated that the boral panels have been included in LRA Table 2.4.2.1-1, Auxiliary Building, with the component type “Spent Fuel Storage Racks” and are managed for aging following Item 3.3.1.09 of the LRA. The staff reviewed LRA Table 2.4.2.1-1 and did not find the component type “spent fuel storage racks” listed in the table. By letter dated February 20, 2003, the staff issued POI-5(c), requesting the applicant to provide a revised LRA Table 2.4.2.1-1, including link 3.3.1.09.

By letter dated March 14, 2003, the applicant responded to POI-5(c) by clarifying that the reference to LRA Table 2.4.2.1-1 in the RAI response was incorrect. The correct reference should have been LRA Table 2.4.2.5-1. The staff finds this response acceptable. POI-5(c) is resolved.

The staff submitted RAI 2.4.2.5-3 to the applicant via letter dated October 11, 2002. In RAI 2.4.2.5-3, the staff stated that the intake structure crane could potentially damage SSCs meeting the scoping criteria in 10 CFR 54.4(a). In addition, SCs of the intake structure crane were passive and long-lived and should be included in LRA Table 2.4.2.5-1 as subject to an AMR. In a letter dated December 12, 2002, in response to RAI 2.4.2.5-3, the applicant stated that administrative operating restrictions and the presence of rail guides (travel limiters) provide the basis for the exclusion of the intake structure crane from the scope of license renewal. NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," addresses the installation of travel limiters to control crane movements such that interaction with safety-related equipment is avoided. Installation of travel limiters and the presence of operating restrictions satisfy the guidelines of NUREG-0612 and avoid the potential safety consequences resulting from a load dropped onto safety-related equipment meeting the scope of the Rule. On the basis of this review and the applicant's crane operating restrictions and travel limiters, the staff found the applicant's response to the RAI acceptable.

On the basis of the above review, the staff did not find any omissions by the applicant of SSCs within the scope of license renewal or SCs subject to an AMR.

2.4.2.5.3 Conclusion

The staff reviewed the LRA, the supporting information in the FCS USAR, and the applicant's responses to the staff's RAIs to determine whether any SSCs that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On this basis, the staff concludes that the applicant has adequately identified the fuel-handling equipment and heavy load crane components that are within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the fuel-handling equipment and heavy load crane components that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2.6 Component Supports

2.4.2.6.1 Summary of Technical Information in the Application

The applicant describes the component supports in LRA Section 2.4.2.6 and provides a list of components subject to an AMR in LRA Table 2.4.2.6-1. Additional information concerning component supports is given in Appendix F of the FCS USAR.

In Section 2.1 of the LRA, the applicant describes its process for identifying structures within the scope of license renewal and subject to an AMR. Based on its methodology, the applicant, in LRA Table 2.2-1 identifies component supports as being within the scope of license renewal and describes the results of its scoping methodology in Section 2.4.2.6 of the LRA. The component supports commodity group consists of the structural connection between a system, or components within a system, and a plant building structural concrete or steel member. Supports for both the distributive portion of systems (pipe, conduit, tubing, raceway) and the system's equipment are included. Component supports include all seismic Categories I and II/I supports for pipe, conduit, raceway, tubing, ventilation duct, and equipment supports. Electrical enclosures for junction boxes, panels, cabinets, and switchgear are also addressed with the component supports commodity group. The exposed portion of the anchor bolts associated with the support are also included.

The component support group includes ASME piping Class 1, 2, and 3 pipe supports and equipment anchorage, CQE and limited-CQE supports for cable trays, conduits, HVAC ducts, tube track, and tubing. It also includes anchorage of racks, panels, cabinets, and enclosures for electrical equipment.

The applicant identified component types for the component supports that are subject to an AMR in Table 2.4.2.6-1 of the LRA. This table lists the component types with their passive function identified and a link to their AMR results. The applicant lists the component types in LRA Table 2.4.2.6-1 that are within the scope of license renewal because they perform one or more of the intended functions of structural support to CQEs or structural support to non-CQEs.

2.4.2.6.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.6 and Appendix F of the FCS USAR to determine whether the support components within the scope of license renewal and subject to an AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1), respectively.

In the performance of the review, the staff selected system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that components having intended functions were not omitted from the scope of the Rule. The staff also focused on components that were not identified as being subject to an AMR to determine if any components were omitted. This was accomplished as described below.

The staff reviewed the component types in LRA Table 2.4.2.6-1 to determine whether any other component supports meet the scoping criteria of 10 CFR 54.4(a) but were not included within the scope of license renewal. The staff then reviewed portions of the USAR descriptions to ensure that all component supports requiring an AMR had been adequately identified and that they were passive and long-lived (i.e., performed their intended functions without moving parts and without a change in configuration or properties and were not subject to replacement based on qualified life or specified time period). The staff also examined the component types in Table 2.4.2.6-1 of the LRA to determine whether they are the only components subject to an AMR in accordance with 10 CFR 54.21(a)(1).

In a letter dated October 11, 2002, the staff requested additional information from the applicant regarding the component types listed in Table 2.4.2.6-1 of the LRA. In RAI 2.4.2.6-1, the staff stated that the applicant had not identified and listed component supports in accordance with 10 CFR 54.21(a)(1). Instead, LRA Table 2.4.2.6-1 generically refers to component supports and provides the material and environment in the first column of the table. Further, component supports such as battery racks, cable tray and conduit, cable tray and conduit supports, Class 1 nuclear steam supply system (NSSS) supports, control boards, control room ceiling, and pipe supports should be listed in LRA Table 2.4.2.6-1 as subject to an AMR.

In a letter dated December 19, 2002, in response to RAI 2.4.2.6-1, the applicant stated that component supports had been treated as a commodity group. In addition, applicable supports for all of the components that have been included within the scope of license renewal are also within the scope and contained in the commodity group of component supports. However, the applicant did not identify the types of supports included in the commodity group. Although the applicant's response to RAI 2.4.2.6-1 indicated that supports such as piping hangars, cable conduit raceway and supports, tubing supports, equipment frames, equipment restraints, and equipment metal spring isolators and fixed bases for pumps, fans, air handlers, chillers, air compressors, and EDGs were included within the component group, the applicant did not provide a supplement to LRA Table 2.4.2.6-1.

The staff, during the November 8, 2002, scoping inspection (NRC Inspection Report 50-285/02-07), verified whether the component supports identified by the applicant were included within scope and documented in an auditable and retrievable form, in accordance with the Rule. During the inspection, the staff reviewed EA-FC-00-068, "Component Supports," dated October 20, 2002, which describes and assesses the commodity group of component supports. Attachment 9.4 of EA-FC-00-068 indicates that the boundary of this commodity group includes all steel and grout for safety-related (CQE) and important to safety (limited-CQE) component supports in the containment structure, auxiliary building, intake structure, and manholes MH-5 and MH-31. The component support commodity group includes ASME piping Class 1, 2, and 3 pipe supports and equipment anchorage, HVAC duct supports, tube track, and tubing supports. It also includes the structural portion and fasteners for racks, panels, cabinets, and enclosures for electrical equipment. Jet impingement barriers and pipe whip restraints were evaluated as part of the structure that houses those components. On the basis of its review of the applicant's response to the RAI, supplemented by the scoping inspection results, the staff found that the applicant has adequately identified the components included within the "component supports" commodity group.

On the basis of the above review, the staff did not find any omissions by the applicant of SSCs within the scope of license renewal.

2.4.2.6.3 Conclusion

The staff reviewed the LRA, the supporting information in the FCS USAR, and the applicant's response to the staff's RAI to determine whether any SSCs that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On this basis, the staff concludes that the applicant has adequately identified the component supports that are within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the component supports that are subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.4.2.7 Duct Banks

2.4.2.7.1 Summary of Technical Information in Application

The applicant describes the duct banks in LRA Section 2.4.2.7 and provides a list of the components subject to an AMR in LRA Table 2.4.2.7-1. The duct banks are further described in USAR Section 8.5.

The duct banks comprise conduits encased in concrete and manholes that are located below grade. They are used to rout electrical power cables between buildings. The electrical manholes are the reinforced concrete box-type structures which allow for inspection and routing of cables. The duct banks and electrical manholes contain both CQE and non-CQE cables.

The applicant determined that only the duct banks and electrical manholes of seismic Class I design that contain CQE cables are within the scope of license renewal.

The boundary of the in-scope duct banks includes the duct banks and electrical manholes connecting the southeast corner of the auxiliary building at pull box 129T and 128T to the intake structure at manhole MH-31. All the concrete, carbon steel, gray cast iron, polyurethane foam, and elastomer materials that form the duct banks and manholes are within the scope of license renewal. From the two pull boxes, the two duct banks combine and connect to manhole MH-5. From manhole MH-5, the duct bank continues to the intake structure where it connects at manhole MH-31. A flexible elastomer joint is used to provide seismic isolation at the connection of the duct bank to manhole MH-31. The elastomer joint and frame, manhole cover and flange, and foam blocks of manhole MH-31 are within the structural boundary. Exposed conduit, conduit fittings, and seismic supports of manhole MH-31 are evaluated as component supports in LRA Section 2.4.2.6. All other portions of manhole MH-31 are evaluated as part of the intake structure in LRA Section 2.4.2.3. The embedded plastic and galvanized steel conduits were used as the form-work during construction and are not within the structural boundary or within the scope of license renewal. The component supports (e.g., cable tray, cable tray supports, pull boxes, associated anchorage) are evaluated as the commodities in LRA Section 2.4.2.6.

In LRA Table 2.4.2.7-1, the applicant lists seven structural component types and their intended functions for the duct banks. The components listed in the table meet the scoping criteria because they perform one or more of the intended functions specified in the table. They also meet the screening criteria for an AMR, because they are passive and perform their intended functions without moving parts or without a change in configuration or properties, and they are not subject to periodic replacement based on qualified life or specified time period.

2.4.2.7.2 Staff Evaluation

The staff reviewed LRA Section 2.4.2.7 and USAR Section 8.5 to determine whether the components of the duct banks within the scope of license renewal and subject to AMR have been identified in accordance with 10 CFR 54.4 and 54.21(a)(1), respectively.

In the performance of this review, the staff selected the system functions described in the USAR that were set forth in 10 CFR 54.4 to verify that the components having intended functions were not omitted from the scope of the Rule. The staff also focused on the components that were not identified as being subject to an AMR to determine if any of these components were omitted.

LRA Section 2.4.2.7 states that the elastomer joint and frame, manhole cover and flange, and foam blocks of manhole MH-31 are within the structure boundary. The LRA also states that exposed conduit, conduit fittings, and seismic supports of manhole MH-31 are evaluated in LRA Section 2.4.2.6 as component supports. Other portions of the manhole are evaluated as part of the intake structure in LRA Section 2.4.2.3. It is not clear from the information provided what portions of MH-31 are evaluated in LRA Section 2.4.2.3. In RAI 2.4.2.7-1, the staff asked the applicant to identify the portions of manhole MH-31 that are evaluated in LRA Section 2.4.2.3 and identify the associated component types listed in LRA Table 2.4.2.3-1.

In its response, the applicant stated that manhole MH-31 is integral with the intake structure. Therefore, the statement “all other portions of manhole MH-31 are evaluated as part of the intake structure (Section 2.4.2.3)” indicates that the concrete structure of MH-31 is included in

Table 2.4.2.3-1 as the component types “Concrete Below Grade” and “Concrete in Ambient Air.”

USAR Section 8.5.1(F) states that there are two pull boxes along the outside of the south wall of the auxiliary building and one manhole between the pull boxes and screen house. However, these components are not identified in LRA Table 2.4.2.7-1. In RAI 2.4.2.7-2, the staff asked the applicant to explain whether the manhole and pull boxes are evaluated as part of the duct banks for license renewal.

In its response, the applicant stated that the manhole is evaluated with the duct banks. The pull boxes are included in LRA Table 2.4.2.6-1 as the component type “Component Support Carbon Structural Steel in Ambient Air.” They are included in the term “Electrical Enclosures” in LRA Section 2.4.2.6.

LRA Section 2.4.2.7 states that exposed conduit fittings and seismic supports of MH-31 are evaluated as component supports (LRA Section 2.4.2.6). However, the components are not addressed in the section. In RAI 2.4.2.7-3, the staff requested the applicant to clarify where in the LRA the exposed conduit and conduit supports associated with MH-31 are discussed. In its response, the applicant stated that the exposed conduit and conduit supports associated with MH-31 are included in Table 2.4.2.6-1 as the component type “Component Support Carbon Structure Steel in Ambient Air.”

The staff has reviewed the information in the LRA, the USAR, and the additional information submitted by the applicant in response to the staff’s RAIs. The staff did not identify any omissions by the applicant relating to scoping of the structures and components in the duct banks. The staff also found that all the passive structures and components identified as being within the scope of license renewal were subject to an AMR.

2.4.2.7.3 Conclusions

The staff reviewed the LRA to determine whether any structures, systems, or components that should be within the scope of license renewal were not identified by the applicant. No omissions were found. In addition, the staff performed an independent assessment to determine whether any components that should be subject to an AMR were not identified by the applicant. No omissions were found. On the basis of this review, the staff concludes that the applicant has adequately identified the structural components of the duct banks that are within the scope of license renewal, as required by 10 CFR 54.4(a), and that the applicant has adequately identified the components of the duct banks that are subject to an aging management review, as required by 10 CFR 54.21(a)(1).

2.4.3 Evaluation Findings

On the basis of this review, the staff concludes that the applicant has adequately identified the structures and structural components that are within the scope of license renewal, in accordance with the requirements of 10 CFR 54.4(a), and that the applicant has adequately identified the structural components that are subject to an aging management review, in accordance with the requirements of 10 CFR 54.21(a)(1).

2.5 Scoping and Screening Results: Electrical and Instrumentation and Controls (I&C)

In Section 2.5, “Scoping and Screening Results: Electrical and Instrumentation and Controls,” of the FCS LRA, the applicant describes the electrical components that are within the scope of license renewal and subject to an AMR. The staff reviewed this section of the LRA to determine whether all safety-related SSCs within the scope of license renewal have been identified, as required by 10 CFR 54.4(a), and whether all structures and components subject to an AMR have been identified, as required by 10 CFR 54.21(a)(1).

2.5.1 Summary of Technical Information in the Application

The applicant performed the screening for electrical/I&C components on a systems, structures and commodity group basis for the in-scope electrical/I&C systems. The applicant used guidance provided in NEI 95-10, Appendix B to define electrical commodities subject to an AMR. The guidance provided in NEI 95-10, Appendix B identifies the passive, long-lived electrical components potentially subject to an aging management review.

The following electrical and I&C systems were identified by the applicant as within the scope of license renewal:

- Cables and Connectors
- Containment Electrical Penetrations
- Engineered Safeguards
- Nuclear Instrumentation
- Reactor Protection System
- 4160 VAC
- 480 VAC
- 480 VAC Motor Control Center
- 125 VDC
- 120 VAC
- Plant Computer
- Qualified Safety Parameter Display
- Radiation Monitoring
- Electrical Equipment
- Auxiliary Instrument Panel
- Control Board
- Diverse Scram System
- Communications
- Emergency Lighting
- Bus Bars

After applying the scoping and screening methodology as discussed in Section 2.1 of the LRA, the applicant determined that the electrical systems, structures and commodities requiring an AMR applicable to FCS are the following:

- Cables and connectors (connectors, splices, terminal blocks)
- Containment electrical penetrations
- Bus Bars

Portions of containment electrical penetrations are a TLAA and are addressed in Section 4.4 of the LRA. The staff's evaluation of this TLAA can be found in Section 4.4 of this SER.

2.5.2 Staff Evaluation

The staff reviewed Section 2.5 of the LRA to determine whether the applicant has identified the electrical components within the scope of license renewal, in accordance with 10 CFR 54.4, and subject to an AMR, in accordance with 10 CFR 54.21(a)(1).

The staff reviewed the basic function of each component type and the applicant's determination of which component types perform their function without moving parts or a change in configuration or properties (passive and long-lived components) and therefore are subject to an AMR.

The following is a list of in-scope electrical component types subject to an AMR:

- Insulated cables and connections (connectors, splices, terminal blocks)
- Containment electrical penetrations
- Bus bars

Finally, the staff reviewed the information submitted by the applicant and determined whether the applicant had omitted or misclassified any electrical components requiring an AMR.

The staff first reviewed the applicant's evaluation to determine whether it has appropriately identified the SSCs required to comply with 10 CFR 50.63 (the SBO rule). The staff found that the screening results in Section 2.5 did not include any offsite power system structures or components related to the recovery of offsite power from an SBO event. The license renewal rule, Section 10 CFR 54.4(a)(3), requires that all SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission regulation for SBO be included within the scope of license renewal. Section 50.63(a)(1) of the SBO rule requires that each light-water-cooled power plant licensed to operate be able to withstand and recover from an SBO of a specified duration (the coping duration) that is based upon factors that include: "(iii) The expected frequency of loss of offsite power, and (iv) The probable time needed to recover offsite power." Licensees' plant evaluations followed the guidance in NRC Regulatory Guide (RG) 1.155 and NUMARC 87-00 to determine their required plant-specific coping duration. The criteria specified in RG 1.155 to calculate a plant-specific coping duration were based upon the expected frequency of loss of offsite power and the probable time needed to restore offsite power, as well as the other two factors (onsite emergency ac power source redundancy and reliability) specified in 10 CFR 50.63(a)(1). In requiring that a plant's coping duration be based on the probable time needed to restore offsite power, 10 CFR 50.63(a)(1) specifies that the offsite power system be an assumed method of recovering from an SBO. Disregarding the offsite power system as a means of recovering from an SBO would not meet the requirements of the SBO rule and would result in a longer required coping duration. The function of the offsite power system within the SBO rule is, therefore, to provide a means of recovering from the SBO. This meets the 10 CFR 54.4(a)(3) criteria as a system that performs a function that demonstrates compliance with the Commission's regulations on SBO. Based on this information, the staff requires that applicable offsite power system structures and components need to be included within the scope of license renewal and subject to an AMR, or additional justification for its exclusion needs to be provided. Therefore, by letter dated October 11, 2002, the staff issued RAI 2.5-1, requesting the applicant to address this issue.

The applicant responded in a letter dated December 19, 2002, that it will revise the license renewal documentation to comply with the NRC Interim Staff Guidance (ISG) on SBO (ISG-02).

In response to RAI 2.5-1, the applicant furnished the following information on the applicable offsite power system structures and components that need to be included within the scope of license renewal and subject to an AMR:

> The SBO restoration includes transformers, circuit breakers, disconnect switches (manual and motor operated), high voltage bus work and transmission cables, transmission towers, supports, actuating relays, blocking relays, indicating lights, alarm logic, and miscellaneous electronic components and switches to allow isolation, transformation, and distribution of 345 kV, 161 kV, and 22 kV power to supply the plant 4.16 kV system.
>
> For recovery from an SBO, two offsite startup power sources are available. The dedicated offsite 161 kV system is brought in via two 161 kV/4.16 kV transformers. The 345 kV system can be converted to an offsite power source by opening the motor operated main generator/transformer disconnect switch DS-T1 and back feeding the plant using the main transformer as a step-down transformer to 22 kV power to feed the 22 kV/4.16 kV transformers. Either offsite power source can operate the four 4.16 kV safety-related buses.
>
> The equipment credited for an SBO includes transformers, circuit breakers, disconnect switches (manual and motor operated), high voltage bus work, aluminum conductor, steel reinforced (ACSR) transmission cables, insulators associated with the transmission conductors, transmission towers and supports, actuating relays, blocking relays, indicating lights, alarm logic, medium and low voltage cable, connectors, terminal blocks, fuse blocks, and miscellaneous electronic components and switches to allow isolation, transformation, and distribution of 345 kV, 161 kV, and 22 kV power to supply the plant 4.16 kV system.
>
> All electrical components within the Substation SBO Restoration System have been considered and were evaluated as in the license renewal boundary with the exception of enclosures, panels, terminal blocks, fuse blocks, connectors, and medium and low voltage cables. Enclosures, panels, and power supplies were identified as commodity groups and are reviewed separately. Medium and low voltage cables, terminal blocks, fuse blocks, and connectors are evaluated as a commodity group for the entire plant.

The applicant's aging management review results for the electrical components for internal environment and external environment are shown in Tables 1 and 2, respectively, of the applicant's response to RAI 2.5-1. Structure and component supports, which protect and support the offsite power system, are also included within the scope of license renewal and subject to an AMR.

The intended electrical function of the offsite power system within the scope of license renewal is to provide "recovery" power after an SBO event. The staff reviewed the basis function of each component type associated with the offsite power system within the scope of license renewal, and the applicant's determination of which component types perform their intended function and therefore are subject to an AMR. The passive, long-lived electrical components comprising the offsite power system that are within the scope of license renewal and subject to an AMR are the following:

- high voltage bus work/duct,
- aluminum conductor,
- steel reinforced (ACSR) transmission cables,
- insulators associated with the transmission conductors,
- transmission towers and supports,
- Non-EQ cables (4 kV and 600 V),

- 125 volt (120 Vac)control cables.

The applicant's aging management review results for the electrical components for external environment are shown in Table 2 of the applicant's response to RAI 2.5-1. This table also refers to plant-specific programs that have been credited for aging management of the SBO restoration system components. However, several SBO components (high voltage bus work/duct, aluminum conductor, steel reinforced (ACSR) transmission cables and insulators associated with the transmission conductors) are not identified in this table as requiring an AMR. Therefore, it was not clear to the staff whether these components are within the scope of license renewal and subject to an AMR. By letter dated February 20, 2003, the staff issued POI-6(a) requesting the applicant to clarify whether these components are within scope and subject to an AMR.

By letter dated March 14, 2003, the applicant responded to POI-6(a) by stating that:

> The high-voltage aluminum conductor is steel reinforced (ACSR) transmission cable and is considered within the scope of license renewal for SBO. In accordance with EPRI TR-114882, "Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools," Rev. 2, 1999, no aging effects were identified for aluminum, aluminum alloys, copper, or copper alloys (brass, bronze) in an indoor or outdoor air environment. Transmission conductor vibration would be caused by wind loading. Wind loading that can cause a transmission line and insulators to vibrate is considered in the design installation. Loss of material (wear) and fatigue that could be caused by transmission conductor vibration or sway are not aging effects requiring management of the period of extended operation at FCS. A review of internal and external operating experience has not identified any aging effects requiring management.
>
> The insulators associated with the transmission conductors are made of porcelain and are within the scope of license renewal. Aging effects that are considered are buildup of surface contaminants and loss of material due to vibration (wear). As indicated above, (transmission line vibration), vibration due to wind loading is a design consideration and not considered an aging effect requiring management. Buildup of surface contaminants (i.e., dust, dirt, etc.) can occur, however, it is gradual and frequently washed away by rain, consequently the buildup of surface contaminants is not significant and therefore not an aging effect requiring management at Fort Calhoun. Information notices (INs) applicable to insulator contamination (IN 93-95) relate to a loss of power due to salt buildup. Fort Calhoun is not located in an area of any salt concentration (Nebraska) and, therefore does not consider this IN applicable. On the basis of the above, it has been determined that the porcelain insulators in outside air at Fort Calhoun are not subject to any aging effects requiring management.
>
> The arresters associated with the offsite power system, although within the SBO boundary, do not have any intended functions associated with license renewal, and are eliminated from the scope of license renewal as active components in accordance with NEI 95-10.
>
> The isolated phase bus duct (i.e., isophase or 22 KV bus duct) encloses bus work that connects the main generator output to the main transformer. It is not related to the underground bus duct that may carry low voltage power, control, and instrumentation wiring. The buswork has no AERM. The enclosures supports for the isophase bus are identified in the LRA and assigned to the structures monitoring program for external environment. There is no AERM for internal environment.
>
> The 125 volt dc and 120 volt ac control and instrumentation cables that are associated with breaker controls and instrumentation within the SBO Restoration System have been considered in the scope of License Renewal for SBO. Under non-EQ cables, all cables are subject to the non-EQ cable AMR. All non-EQ cable was identified in, and managed by, the non-EQ cable aging management program (B.3.4).

On the basis of the information provided in response to POI-6(a), the staff concludes that the applicant has identified the SSCs that are within scope and subject to an AMR. POI-6(a) is resolved.

In conclusion, the staff reviewed all of the electrical and I&C systems and components at FCS to determine whether any structures, systems or components that met the license renewal scoping criteria were not identified by the applicant. The staff found that the several SSCs associated with meeting the SBO Rule were not initially identified in the LRA. These SSCs were subsequently brought into scope. However, with the exception of the offsite power system structures and components related to the recovery of offsite power from an SBO event which were omitted, no other omissions were found. Therefore, on the basis of this review, the staff finds that the SSCs related to the SBO recovery path that are within the scope of license renewal have been identified, as required by 10 CFR 54.4(a), and that the SBO structures and components that are subject to an aging management review have been identified, as required by 10 CFR 54.21(a)(1).

2.5.3 Cables and Connectors

Section 2.5.1, "Cables and Connectors," in the LRA identifies cable and connectors as long-lived and non-EQ component groups that perform an electrical passive function in support of its system intended function as defined by 10 CFR Part 54.21(a)(1)(i).

2.5.3.1 Summary of Technical Information in the Application

Section 2.5.1 of the LRA states that cables and their associated connectors provide electrical connections to deliver electrical energy either continuously or intermittently to various equipment and components throughout the plant to enable them to perform their intended functions. It states that the cables and connectors associated with 10 CFR 50.49 (the EQ Rule) are addressed either as short lived and periodically replaced, or as long-lived time-limited aging analysis (TLAA) candidates, and therefore these are not included in the set of cables and connectors that require additional aging management review.

The applicant has evaluated the cables and connectors as commodities across system boundaries. This is termed the spaces approach in Section 2.5.3.1 of the SRP-LR. Table 2.5.1-1 of the LRA defines component types that are subject to aging management and their intended functions. The application states that these cables and connectors are within the scope of license renewal and are subject to an aging management review.

Section 2.5.1 of the LRA lists these components to be the following:

- Electrical Cable
- Connector
- Splices
- Fuse Block
- Terminal Block

2.5.3.2 Staff Evaluation

The staff reviewed Section 2.5.1 of the LRA to determine whether the applicant has identified the cables and connectors within the scope of license renewal. This is in accordance with 10 CFR 54.4. The staff also reviewed this section of the LRA to determine whether the applicant has identified the cables and connectors subject to an AMR. This is in accordance with 10 CFR 54.21(a)(1).

The applicant evaluated the cables and connectors as commodities across system boundaries on a plant-wide basis. Section 2.5.1 of the LRA states that the plant-wide evaluation included all cables and connectors in these areas to provide the complete coverage of cables and connectors within the scope of license renewal. Table 2.5.1-1 of the LRA indicates that the passive function of the cables and connectors is to conduct electricity, and the cable and connectors are subject to an AMR. The staff agrees that the applicant has correctly identified the cables and connectors as components that perform their function without moving parts or a change in configuration or properties (passive and long-lived) and are therefore subject to an AMR.

2.5.3.3 Conclusions

On the basis of the staff's review of the cable and connector information presented in Section 2.5.1 of the LRA and the supporting information in its USAR, the staff did not find any omissions by the applicant. The staff therefore concludes that the applicant has identified those cables and connectors that are within the scope of license renewal, as required by 10 CFR 54.4(a), and subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.5.4 Containment Electrical Penetrations

Section 2.5.2, "Containment Electrical Penetrations," of the LRA identifies electrical penetrations as a passive, long-lived component group that perform the functions of a containment boundary and provide electrical energy across the containment boundary to power various equipment and components throughout the plant to support their intended functions.

2.5.4.1 Summary of Technical Information in the Application

The LRA describes containment electrical penetrations as passive, long-lived component assemblies that provide a containment boundary and provide an electrical connection between two sections of the electrical/I&C circuits for conducting electrical power (voltage and current), either continuously or intermittently throughout the plant. The pigtail at each end of the penetration is connected to the field cable in various ways. The boundary of the electrical penetrations includes the pigtails. Containment electrical penetrations that are associated with 10 CFR 50.49 are addressed as short-lived and periodically replaced, or as long-lived TLAA components. The containment electrical penetrations that are classified as short-lived and periodically replaced, or TLAA are not included in the set of penetrations requiring aging management review.

2.5.4.2 Staff Evaluation

The staff reviewed Section 2.5.2 of the LRA to determine whether the applicant has identified the containment electrical penetrations that are within the scope of license renewal. This is in accordance with 10 CFR 54.4. The staff also reviewed this section of the LRA to determine whether the applicant has identified the electrical penetrations subject to an AMR, in accordance with 10 CFR 54.21(a)(1). The containment electrical penetrations identified by the applicant requiring an AMR are non-safety related (non-EQ) and used plant-wide to conduct electrical power (voltage and current), either continuously or intermittently between two sections of the electrical/I&C circuits supplying power to various equipment in the containment. The staff reviewed these component categories against the requirements in 10 CFR 54.4(a)(2) and 10 CFR 54.4(b) and found that those categories are included in the requirements. The staff reviewed the information in the USAR and found that the applicant has identified the containment electrical penetrations that are within the scope of license renewal and subject to an AMR.

2.5.4.3 Conclusions

On the basis of the staff's review of the containment electrical penetrations information presented in Section 2.5.2 of the LRA and the supporting information in the USAR, the staff did not find any omissions by the applicant. The staff therefore concludes that the applicant has identified those penetrations that are within the scope of license renewal as required by 10 CFR 54.4(a), and subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.5.5 Bus Bars

Section 2.5.20, "Bus Bars," of the LRA identifies bus bars as a component group that performs an passive electrical function in support of its system intended function.

2.5.5.1 Summary of Technical Information in the Application

The LRA describes bus bars and its standoffs as a component assembly conducting electrical power (voltage and current), either continuously or intermittently, between various equipment and components throughout the plant. The bus bars are a pre-assembled raceway design, with bus bars mounted on insulated supports (standoffs). The intended function of the standoffs is to support the electrical bus bars.

Based on a review of the materials of construction and operating environments, there are no applicable aging affects for these materials.

The justification for the bus bar and the stand off materials not requiring aging management was presented in the electrical bus bar aging management review, and is maintained in onsite documentation for review.

2.5.5.2 Staff Evaluation

The staff reviewed Section 2.5.20 of the LRA to determine whether the applicant has identified the bus bars within the scope of license renewal. This is in accordance with 10 CFR 54.4. The staff also reviewed this section of the LRA to determine whether the applicant has identified the bus bars subject to an AMR. This is in accordance with 10 CFR 54.21(a)(1).

The bus bars identified by the applicant consist of bus bars that are safety-related, SBO-related, and fire protection-related, and are used plant-wide to conduct electrical power (voltage and current), either continuously or intermittently between various equipment. The staff reviewed these component categories against the requirements in 10 CFR 54.4(a)(1), (2) and (3), and 10 CFR 54.4(b) and found that those categories are included in the requirements. The staff reviewed the information in the USAR and found that the applicant has identified all bus bars within the scope of license renewal.

2.5.5.3 Conclusions

On the basis of the staff's review of the bus bar information presented in Section 2.5.20 of the LRA, and the supporting information in the USAR, the staff did not find any omissions by the applicant. The staff therefore concludes that the applicant has identified those bus bars that are within the scope of license renewal, as required by 10 CFR 54.4(a), and subject to an AMR, as required by 10 CFR 54.21(a)(1).

2.5.6 Other Electrical Systems

The applicant determined that the following electrical systems are within the scope of license renewal, but are not subject to an aging management review because all components remaining after the commoditization of common component types, were found to be active:

- Engineered Safeguards
- Nuclear Instrumentation
- Reactor Protection System
- 4160 VAC
- 480 VAC
- 480 VAC Motor Control Center
- 125 VDC
- 120 VAC
- Plant Computer
- Qualified Safety Parameter Display
- Radiation Monitoring
- Electrical Equipment
- Auxiliary Instrument Panel
- Control Board
- Diverse Scram System
- Communications
- Emergency Lighting

On this basis, the staff finds that the components in the remaining electrical systems are not subject to an AMR.

2.5.7 Evaluation Findings

On the basis of the staff's review of the information presented in Section 2.5 of the LRA and the additional information provided by the applicant in response to the staff's RAI, the staff concludes that the applicant has identified those parts of the electrical systems that are within the scope of license renewal, as required by 10 CFR 54.4(a), and subject to an AMR, as required by 10 CFR 54.21(a)(1).

SECTION 3

AGING MANAGEMENT REVIEWS

Section 3 - Table of Contents

3 Aging Management Review

The Omaha Public Power District (OPPD) is the first license renewal applicant to fully utilize the Generic Aging Lessons Learned (GALL) process. The purpose of GALL is to provide the staff with a summary of staff-approved aging management programs (AMPs) for the aging of structures and components that are subject to an aging management review (AMR). If an applicant commits to implementing these staff-approved AMPs, the time, effort, and resources used to review an applicant's license renewal application (LRA) will be greatly reduced, thereby improving the efficiency and effectiveness of the license renewal review process. The GALL Report is a compilation of existing programs and activities used by commercial nuclear power plants to manage the aging of structures and components within the scope of license renewal and which are subject to an AMR. The GALL Report summarizes the aging management evaluations, programs, and activities credited for managing aging for most of the structures and components used throughout the industry. The report also serves as a reference for both applicants and staff reviewers to quickly identify those AMPs and activities that the staff has determined will provide adequate aging management during the period of extended operation.

The GALL Report identifies (1) systems, structures, and components, (2) component materials, (3) the environments to which the components are exposed, (4) the aging effects associated with the materials and environments, (5) the AMPs that are credited with managing the aging effects, and (6) recommendations for further applicant evaluations of aging effects and their management for certain component types.

In order to determine whether the GALL process would improve the efficiency of the license renewal review, the staff conducted a demonstration project to exercise the GALL process and to determine the format and content of a safety evaluation based on this process. The results of the demonstration project confirmed that the GALL process will improve the efficiency and effectiveness of the LRA review while maintaining the staff's safety focus. The Standard Review Plan for License Renewal (SRP-LR) was prepared based on both the GALL model and the lessons learned from the demonstration project.

During its review of the FCS LRA, the staff performed an aging management review (AMR) inspection from January 6-10, 2003, and from January 20-23, 2003. The purpose of the inspection was to examine activities that support the LRA, and consisted of an examination of procedures, representative records, and interviews with the applicant regarding proposed aging management activities. The inspection team also reviewed the proposed implementation of 19 of the 24 AMPs credited in the LRA for managing aging. On the basis of the inspection team's review of the proposed implementation of the 19 AMPs, the staff finds that the applicant will adequately implement the AMPs credited for managing aging during the extended period of operation. The inspection team concluded that the existing aging management activities are being conducted as described in the LRA and that new aging management activities appear to be acceptable for managing plant aging.

Concurrent with the AMR inspection, the staff performed a separate audit of specific issues raised by staff reviewers. On the basis of the information gathered during the audit, the staff finds that the applicant has adequately addressed the specific issues raised by the staff reviewers. The audit issues can be found in the staff's audit report dated April 9, 2003, and are addressed in this SER.

In its letter dated March 14, 2003, the applicant provided revisions to many tables in license renewal application (LRA) Sections 2 and 3. The staff needed to review the revised information to determine whether the revisions change the staff's conclusions as documented in this safety evaluation report (SER). This was identified as Open Item 3.0-1.

In Appendix A of the referenced letter, OPPD resubmitted LRA tables incorporating changes made since the April 2002 LRA revision. The revised tables were formatted to indicate which changes were made as a result of responses to NRC RAIs/POIs or as a result of additional applicant reviews of system EAs.

Subsequent to the submittal, the NRC project manager created a summary matrix of the LRA table changes. On May 28 and 29, 2003, the NRC conducted a public meeting to discuss the FCS SER open and confirmatory items. During the course of that meeting, the LRA table changes, and the bases for the changes, were discussed with the applicable NRC reviewers. The applicant revised the summary matrix to reflect the meeting conclusions. Appendix A of the applicant's submittal dated July 7, 2003, and clarifications provided by the applicant on August 7, 2003, contain the revised summary of revisions to the FCS LRA tables matrix. The matrix columns include the line item number, the table in which the change was made, a description of the change, the reason for the change, whether the change was accepted at the public meeting, and clarification about the change where requested by the NRC reviewers.

The staff reviewed the revised information to determine whether the revisions alter the staff's conclusions as documented in the open items of the SER. As a result of its review of the revised information, the staff concludes that the revisions provided by the applicant demonstrate that the SCs at FCS that are subject to an AMR will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3). Open Item 3.0-1 is closed.

As a result of the staff's review of the FCS application for license renewal, including the additional information and clarifications submitted subsequently, the staff identified two license conditions. The first license condition requires the applicant to include the USAR Supplement in the next USAR update required by 10 CFR 50.71(e) following issuance of the renewed license. The second license condition requires that the future inspection activities identified in the USAR Supplement be completed prior to the period of extended operation.

3.0.1 The GALL Format for the LRA

The Fort Calhoun Station, Unit 1 (FCS) LRA closely follows the standard LRA format, as agreed to between the Nuclear Energy Institute (NEI) and the staff (see letters dated August 9, 1999, and September 22, 1999). This format has been used by previous applicants and will continue to be used by future applicants. However, there are several important changes within the format to reflect the GALL process. First, the tables in LRA Section 2 that identify the structures and components that are subject to an AMR now include a third column that links plant-specific structures and components in the Section 2 tables to generic GALL component groups discussed in Section 3 (this is described in more detail below). Second, the tables in LRA Section 3 are different from the Section 3 tables used in previous LRAs. There are no system- or structure-specific tables in Section 3 of the FCS LRA. The individual components within a system or structure have been included in a series of system/structural group tables. For example, there are 20 auxiliary systems at FCS. Each system has several components. In previous LRAs, each system had a separate table that listed the components within the system. In the FCS LRA, there are no system tables. Instead, all the components in the 20 auxiliary systems are included in any one of three auxiliary system tables. LRA Table 3.3-1 consists of auxiliary system components evaluated in the GALL Report, LRA Table 3.3-2 consists of FCS auxiliary systems components not evaluated in the GALL Report, and LRA Table 3.3-3 consists of FCS auxiliary systems components that were not evaluated in the GALL Report, but the applicant has determined can be managed using a GALL AMR and associated AMP. Similarly, the LRA tables for the other system groups (3.1 - reactor systems, 3.2 - engineered safety features systems, 3.4 - steam and power conversion systems, 3.5 - containment, structures, and component supports, and 3.6 - electrical and instrumentation and control (I&C) systems) have 3.x-1 LRA tables for components evaluated in the GALL Report, 3.x-2 LRA tables for components not evaluated in the GALL Report, and 3.x-3 LRA tables for components that were not evaluated in the GALL Report, but the applicant has determined can be managed using a GALL AMR and associated AMP.

The 3.x-1 LRA tables have six columns. Column 1 identifies the system group, table number, and row number. For example, 3.1.1.01 identifies Table 3.1-1, row 1. This information is repeated in the last column of the Section 2 tables, and allows the staff reviewer to link each plant-specific structure and component identified in the Section 2 tables to the generic structure and component types identified in the Section 3 tables. Column 2 of the 3.x-1 LRA tables lists the generic structure and component types evaluated in GALL. Column 3 identifies the applicable aging effects experienced by the structure or component. Column 4 identifies the AMP that the GALL Report credits for managing the aging effect identified in Column 3. Column 5 indicates whether the GALL Report recommends further evaluation of the management of the aging effect(s). Column 6 provides plant-specific information regarding management of the aging effect(s). Columns 2 through 5 of the 3.x-1 LRA tables are taken directly from the associated tables in the SRP-LR and GALL Report. Column 6 tells the staff reviewer whether or not the FCS AMP is consistent with GALL, and provides information on the material and environment associated with the component group. This column also provides additional information if the aging management differs from what is assumed in GALL, and provides information on any additional evaluations that GALL recommends.

The 3.x-2 LRA tables contain structures and components that were not evaluated in GALL. Because these structures and components were not evaluated in GALL, the staff had to perform a full review, just like those done for past applications.

The 3.x-2 LRA tables also have six columns, but the columns are different from those in the 3.x-1 LRA tables. The 3.x-2 LRA tables look very much like the Section 3 tables in previous applications. The first column identifies the system group, table number, and row number in the table. For example, 3.3.2.01 identifies LRA Table 3.3-2, row 1. Column 2 of LRA Table 3.x-2 identifies the type of structure or component being evaluated. Column 3 identifies the structure or component material, while Column 4 identifies the environment that the structure or component is exposed to. Column 5 identifies the applicable aging effect, and Column 6 identifies the AMP that is credited for managing the aging effect.

Because these components were not evaluated in GALL, the staff determined the adequacy of the aging management evaluation and programs in the same manner as for previous applications.

The 3.x-3 LRA tables contain structures and components that were not evaluated in GALL, but the applicant has determined that the materials, environments, and aging effects are bounded by the GALL evaluation and that the GALL AMPs can be applied to these structures and components.

The 3.x-3 LRA tables have eight columns. Columns 1 and 2 are the same as in the other tables. Column 3 identifies the structure or component material. Column 4 identifies the environment to which the structure or component is exposed. Column 5 identifies the applicable aging effect. Column 6 identifies the FCS AMP. Column 7 identifies the applicable GALL AMR evaluation that the applicant credits for managing the aging effect, and Column 8 provides a justification for applying the GALL AMR evaluation to the structure or component.

For structures and components in the 3.x-3 LRA tables, the staff performed a traditional evaluation of the aging management results, and determined whether the GALL evaluation is applicable to the structure or component.

3.0.2 The Staff's Review Process

The staff's review of the FCS LRA was performed in three phases. In Phase 1, the staff reviewed the applicant's AMP descriptions to compare those AMPs for which the applicant claimed consistency with those reviewed and approved in the GALL Report. For those AMPs for which the applicant claimed consistency with the GALL AMPs, the staff conducted an inspection to confirm that the applicant's AMPs were consistent with the GALL AMPs.

Several FCS AMPs were described by the applicant as being consistent with GALL, but with some deviation from GALL. By letter dated October 11, 2002, the staff issued request for additional information (RAI) B.1-1, requesting the applicant to define the AMP deviations contained in the LRA. By letter dated December 19, 2002, the applicant addressed this RAI by defining the following three types of AMP deviations

(1) Exceptions to GALL are defined as specified GALL requirements that the applicant does not intend to meet or implement

(2) Clarifications to GALL are defined as GALL requirements that the applicant intends to meet, but that may deviate from the exact wording or criteria specified in the GALL Report as documented in the LRA

(3) Enhancements to GALL are defined as revisions or additions to plant procedures or program activities that will be implemented prior to the period of extended operation. Enhancements to an AMP may expand the scope of the AMP, but will not reduce its scope, thus ensuring that the AMP still meets the consistency requirements provided in the GALL Report.

For each AMP that had one or more of these deviations, the staff reviewed each deviation to determine (1) whether the deviation is acceptable, and (2) whether the AMP, as modified, would adequately manage the aging effect(s) for which it is credited.

For those AMPs that are not evaluated in GALL, the staff evaluated the AMP against the 10 program elements defined in Branch Technical Position (BTP) RLSB-1 in Section A-1 of SRP-LR Appendix A and used in previous LRA evaluations.

The staff also reviewed the updated safety analysis report (USAR) supplement for each AMP to determine whether it provided an adequate description of the program or activity, as required by Section 54.21(d) of Chapter 10 of the *Code of Federal Regulations* (10 CFR 54.21(d)).

The AMRs and associated AMPs in the GALL Report fall into two broad categories: those AMRs and associated AMPs that GALL concludes are adequate to manage the aging of the components referenced in GALL, and those AMRs and associated AMPs for which GALL concludes that aging management is adequate, but further evaluation must be done for certain aspects of the aging management process. In Phase 2, the staff compared the applicant's AMR results and associated AMPs to the AMR results and associated AMPs in GALL to determine whether the applicant's AMRs and associated AMPs were consistent with those reviewed and approved in the GALL Report. For those AMR results and associated AMPs for which the applicant claimed to be consistent with GALL, and for which GALL did not recommend further evaluation, the staff conducted an inspection to confirm that the applicant's AMRs and associated AMPs were consistent with the GALL AMRs and associated AMPs. For those AMRs and associated AMPs for which GALL recommended further evaluation, in addition to its confirmatory inspection, the staff reviewed the applicant's evaluation to determine whether it addressed the additional issues recommended in the GALL Report. Finally, for AMRs and associated AMPs that were not consistent with GALL, the staff's review determined whether the AMRs and associated AMPs were adequate to manage the aging effects for which they were credited.

Once it had determined that the applicant's AMRs and associated AMPs were adequate to manage aging, the staff performed Phase 3 of its review by reviewing plant-specific structures and components to determine whether the applicant demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis (CLB) for the period of extended operation, as required by 10 CFR 54.21(a)(3). Specifically, this review involved a component-by-component review to determine whether the applicant properly applied the GALL program to the aging management of components within the scope of license renewal and subject to an AMR (i.e., the staff evaluated whether the applicant had properly identified the aging effects, and the AMPs credited for managing the aging effects, for each FCS structure and component within the scope of license renewal and subject to an AMR). For structures and components evaluated in GALL, the staff reviewed the adequacy of aging management against the GALL criteria. For structures and components not evaluated in GALL, the staff reviewed the adequacy of aging management against the 10 criteria in Appendix A of the SRP-LR. Some FCS structures and components were not evaluated in GALL, but the applicant determined that the GALL AMR results could be applied to these structures and components and provided justification to support this determination. In these cases, the staff reviewed the adequacy of aging management against the GALL criteria to determine whether the GALL AMPs were adequate to manage the aging effects for which they were credited.

As part of the staff's review, an AMR inspection was performed from January 6-10, 2003 and from January 20-23, 2003 to examine activities that support the LRA. The inspection consisted of an examination of procedures and representative records, and interviews with personnel regarding the proposed aging management activities to support license renewal. The inspection concluded that the existing aging management activities are being conducted as described in the LRA and proposed aging management activities appear acceptable to manage plant aging.

Concurrent with this inspection, the staff performed a separate audit of specific issues raised by staff reviewers. The audit findings were issued on April 9, 2003.

3.0.3 Aging Management Programs

Table 3.0.3-1 presents the common AMPs, the associated GALL program(s), the system groups that credit the program for management of component aging, and the section of the safety evaluation report (SER) that contains the staff's review of the program.

Table 3.0.3-1

Common Aging Management Programs

Applicant's AMP (LRA section)	Associated GALL AMP	LRA System Groups that Credit the AMP for Aging Management	Staff Evaluation (SER Section)
Bolting Integrity (B.1.1)	XI.M3, XI.M18	3.1 - Reactor Systems 3.2 - ESF 3.3 - Auxiliary 3.4 - Steam and Power Conversion	3.0.3.1
Chemistry (B.1.2)	XI.M2, XI.M21	3.1 - Reactor Systems 3.2 - ESF 3.3 - Auxiliary 3.4 - Steam and Power Conversion 3.5 - Structures	3.0.3.2
Containment ISI (B.1.3)	X.S1, XI.S1, XI.S2	3.5 - Structures 4.5 - Concrete and Containment Tendon Pre-Stress TLAA	3.0.3.3
Flow-Accelerated Corrosion (B.1.5)	XI.M17	3.1 - Reactor Systems 3.4 - Steam and Power Conversion	3.0.3.4

Inservice Inspection (B.1.6)	XI.M1, XI.S3	3.1 - Reactor Systems 3.5 - Structures	3.0.3.5
Boric Acid Corrosion Prevention (B.2.1)	XI.M10	3.1 - Reactor Systems 3.2 - ESF 3.3 - Auxiliary 3.4 - Steam and Power Conversion 3.5 - Structures 3.6 - Electrical	3.0.3.6
Cooling Water Corrosion (B.2.2)	XI.M20, XI.M21	3.2 - ESF 3.3 - Auxiliary 3.4 - Steam and Power Conversion	3.0.3.7
Fatigue Monitoring (B.2.4)	X.M1	3.1 - Reactor Systems 4.3 - Metal Fatigue TLAA	3.0.3.8
Fire Protection (B.2.5)	XI.M26, XI.M27	3.3 - Auxiliary 3.5 - Structures	3.0.3.9
Periodic Surveillance and Preventive Maintenance (B.2.7)	Plant-Specific	3.2 - ESF 3.3 - Auxiliary 3.4 - Steam and Power Conversion 3.5 - Structures	3.0.3.10
Structures Monitoring (B.2.10)	XI.S5, XI.S7	3.3 - Auxiliary 3.5 - Structures	3.0.3.11
General Corrosion of External Surfaces (B.3.3)	Plant-Specific	3.2 - ESF 3.3 - Auxiliary 3.4 - Steam and Power Conversion 3.5 - Structures	3.0.3.12
One-Time Inspection (B.3.5)	XI.M32	3.1 - Reactor Systems 3.2 - ESF 3.3 - Auxiliary 3.4 - Steam and Power Conversion	3.0.3.13

Selective Leaching (B.3.6)	XI.M33	3.2 - ESF 3.3 - Auxiliary 3.4 - Steam and Power Conversion 3.5 - Structures	3.0.3.14

Table 3.0.3-2 presents the system-specific AMPs, the associated GALL program(s), the system groups that credit the program for management of component aging, and the SER section that contains the staff's review of the program.

Table 3.0.3-2

System-Specific Management Programs

Applicant's AMP (LRA section)	Associated GALL AMP	LRA System Groups that Credit the AMP for Aging Management	Staff Evaluation (SER Section)
Containment Leak Rate (B.1.4)	XI.S1, XI.S4	3.5 - Structures	3.5.2.3.1
Reactor Vessel Integrity (B.1.7)	XI.M31	3.1 - Reactor Systems	3.1.2.3.1
Diesel Fuel Monitoring and Storage (B.2.3)	XI.M30	3.3 - Auxiliary Systems	3.3.2.3.1
Overhead Load Handling Systems Inspection (B.2.6)	XI.M23	3.3 - Auxiliary Systems	3.5.2.3.2
Reactor Vessel Internals Inspection (B.2.8)	XI.M13, XI.M16	3.1 - Reactor Systems	3.1.2.3.2
Steam Generator (B.2.9)	XI.M19	3.1 - Reactor Systems	3.1.2.3.3
Alloy 600 (B.3.1)	XI.M11	3.1 - Reactor Systems	3.1.2.3.4
Buried Surfaces External Corrosion (B.3.2)	XI.M34	3.3 - Auxiliary Systems	3.3.2.3.2

Non-EQ Cable Aging Management (B.3.4)	XI.E1, XI.E2, XI.E3	3.6 - Electrical and I&C Systems	3.6.2.3.1
Thermal Embrittlement of Cast Austenitic Stainless Steel (B.3.7)	XI.M12	3.1 - Reactor Systems	3.1.2.3.5

3.0.3.1 Bolting Integrity Program

3.0.3.1.1 Summary of Technical Information in the Application

The applicant's bolting integrity program is discussed in LRA Section B.1.1, "Bolting Integrity Program." The applicant states that the program is consistent with GALL programs XI.M3, "Reactor Head Closure Studs," and XI.M18, "Bolting Integrity," with the exception that the applicant did not identify stress corrosion cracking (SCC) as an aging effect requiring management for high-strength carbon steel bolting in plant indoor air. The applicant also states that it will utilize American Society of Mechanical Engineers (ASME) Section XI, Subsection IWF, visual VT-3 inspection requirements rather than volumetric inspections for the inspection of supports.

This AMP is credited with managing aging in bolts in the reactor, ESF, auxiliary, and steam and power conversion systems.

The applicant performed inspections of bolted components under the FCS inservice inspection (ISI) program, the boric acid corrosion (BAC) prevention program, and the structures monitoring program (SMP). The SMP inspects structural bolts. Visual inspections conducted under the BAC prevention program included the inspection of bolted components in borated systems. Any indication of boric acid residue or damage is reported and evaluated to determine if a component can remain in service per established procedures. Documentation of operating experience is included as part of the BAC prevention program. On occasion, visual observations have identified BAC damage. These deficiencies were documented in accordance with the FCS corrective action program (CAP) and resulted in repair or replacement, if required. Review of the plant-specific operating experience indicates that the inspections have been effective in managing the aging effects of bolted components.

3.0.3.1.2 Staff Evaluation

In LRA Section B.1.1, "Bolting Integrity Program," the applicant described its AMP to manage aging in bolting. The LRA stated that this AMP is consistent with GALL AMPs XI.M3, "Reactor Head Closure Studs," and XI.M18, "Bolting Integrity," with the exception that the applicant did not identify SCC as an aging effect requiring management for high-strength carbon steel bolting in plant indoor air. The applicant also stated that it will utilize ASME Section XI, Subsection IWF, visual VT-3 inspection requirements, rather than volumetric inspections, for the inspection of supports. The staff confirmed the applicant's claim of consistency during the AMR inspection. Furthermore, the staff reviewed the deviation and its justification to determine whether the AMP, with the deviation, remains adequate to manage the aging effects for which it is credited, and reviewed the USAR Supplement to determine whether it provides an adequate description of the revised program.

In RAI B.1.1-1, issued by letter dated October 11, 2002, the staff requested that the applicant address its statement in Section B.1.1 of the LRA, that the bolting integrity program is consistent with the GALL Report, with the exception that FCS has not identified SCC as a creditable aging effect requiring management for high-strength carbon steel bolting in plant indoor air. The staff indicated that its understanding is that this exception means that this program will follow all the requirements in NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," dated July 2001, with the exception of high-strength carbon steel bolting for steel structures, pipe supports, heating, ventilation, and air conditioning (HVAC) supports, electrical supports, and equipment supports. The staff requested that the applicant verify that the staff's understanding of the program is correct. The applicant's response by letter dated December 19, 2002, stated that the NRC staff's understanding of the program is correct. However, the applicant, in its response, did not discuss the exclusion of the aging effect of SCC regarding high-strength carbon steel bolting in plant indoor air or why an ASME Section XI, Subsection IWF, visual VT-3 inspection, rather than volumetric inspections, is adequate to inspect supports.

By letter dated February 20, 2003, the staff, in potential open item (POI)-7(a), requested that the applicant provide the basis for the exclusion of SCC as a plausible aging effect for high-strength carbon steel bolting in plant indoor air, as well as the basis for why a VT-3 inspection is sufficient to inspect supports. By letter dated March 14, 2003, the applicant clarified that the basis for excluding SCC as a plausible aging effect for high-strength carbon steel bolting in plant indoor air can be found in the response to RAI 3.2.1-2, submitted by the staff by letter dated December 12, 2002. In the response to RAI 3.2.1-2, the applicant stated that stainless steels, high-strength aluminum alloys, and brasses are the most susceptible alloys to SCC. Ordinary steels are not as susceptible. Secondly, SCC requires exposure to specific chemical solutions for the mechanism to occur. Stainless steels require chloride-laden solutions. Aluminum alloys require sodium chloride solutions. Brasses require ammonia solutions. Ordinary steels require exposure to caustic or mixed acid solutions. Thirdly, elevated temperature is usually a factor when SCC occurs. Thus, for the carbon steel bolting in question, SCC is not an issue because (1) the material is not readily susceptible to SCC, (2) a caustic or mixed acid solution environment is not present, and (3) elevated temperatures are not present. With regard to VT-3 inspections, in its response to POI-7(a), the applicant stated that support bolting does not perform a pressure-retention function like flange bolting, pump casing bolting, etc.

The staff has reviewed the applicant's response to POI-7(a) and RAI 3.2.1-2 and agrees that the conditions and environments needed for SCC to occur in high-strength carbon steel bolting in plant indoor air are not present at FCS. In addition, the staff agrees that the function of the support bolting does not warrant a volumetric inspection, and that a VT-3 inspection is sufficient. POI-7(a) is resolved.

The staff reviewed the applicant's operating experience with regard to the management of bolted components, as provided in LRA Section B.1.1. LRA Section B.1.1 states that inspections of bolted components have been conducted under the FCS ISI program, BAC prevention program, and the SMP. On occasion, visual observations have identified BAC damage. These deficiencies were documented in the FCS CAP and resulted in repair or replacement, if required. The applicant concludes, and the staff agrees, that the plant-specific operating experience indicates that visual inspections have proved effective in managing the aging effects of bolted components.

LRA Section A.2.2 provides the applicant's USAR Supplement describing the bolting integrity program. The staff reviewed the USAR Supplement and finds it to be an adequate description of the bolting integrity program.

3.0.3.1.3 Conclusions

On the basis of its review and inspection of the applicant's program, the staff finds that those portions of the program for which the applicant claims consistency with GALL are consistent with GALL. In addition, the staff has reviewed the exceptions to the GALL program and finds that the applicant's program provides for adequate management of the aging effects for which the program is credited. The staff also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Therefore, on the basis of its review, the staff concludes that the applicant has demonstrated that the bolting integrity program will effectively manage aging in the structures and components for which this program is credited so that the intended functions of the associated components and systems will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.0.3.2 Chemistry Program

3.0.3.2.1 Summary of Technical Information in the Application

The applicant's water chemistry program is discussed in LRA Section B.1.2, "Chemistry Program." The applicant states that the program is consistent with GALL program XI.M2, "Water Chemistry," and includes the chemistry-related portions of the program in GALL XI.M21, "Closed-Cycle Cooling Water System." This extends its applicability to the systems containing closed-cycle cooling water.

This AMP is credited with managing aging effects caused by primary and secondary water chemistries, and by the water chemistry in the component cooling water (CCW) system. It is based on the Electric Power Research Institute (EPRI) water chemistry guidelines. These guidelines are referenced in the following EPRI reports, Topical Report (TR)-105714 for primary water chemistry, TR-102134 for secondary water chemistry, and TR-107396 for closed-cycle cooling water chemistry.

The chemistry program will also manage the aging effects on components which either are not evaluated in GALL, or, although not specifically evaluated, are relying on the AMPs in GALL. These components are listed in Tables 3.1-2 through 3.5-2 and Tables 3.1-3 through 3.5-3 of the LRA. They are included in reactor systems, engineering safety features systems, auxiliary systems, steam and power conversion systems, and containment, structures and component supports. The components are made of carbon steel, stainless steel, cast austenitic stainless steel (CASS), low-alloy steel, cast iron, and nickel-based and copper alloys. When exposed to the environments of primary, secondary, or closed-cycle cooling water, the resulting aging effect is cracking and loss of material caused by general, crevice, pitting, galvanic, and microbiologically-influenced corrosion. The chemistry program manages these aging effects by specifying water chemistries which minimize corrosive damage.

3.0.3.2.2 Staff Evaluation

In LRA Section B.1.2, “Chemistry Program,” the applicant described its AMP to manage aging effects by controlling primary, secondary, and closed-cycle cooling water chemistries. The LRA stated that this AMP is consistent with the chemistry program in Section XI.M2 of the GALL Report with an enhancement resulting from the inclusion of the chemistry-related portions of the GALL closed-cycle cooling water system program. The staff confirmed the applicant’s claim of consistency during the AMR inspection. Furthermore, the staff reviewed the enhancement and its justification to determine whether the AMP, with the enhancement, remains adequate to manage the aging effects for which it is credited. The staff also reviewed the USAR Supplement to determine whether it provides an adequate description of the program.

The inclusion of the information discussed above causes changes in some attributes of the GALL chemistry program. Therefore, the staff reviewed this AMP against only those attributes of the applicant’s program which deviate from the attributes of the GALL chemistry program, using the guidance in BTP RLSB-1 in Appendix A of the SRP-LR.

[Preventive Actions] In addition to controlling water chemistry to minimize exposure of the affected components to aggressive chemistry environments, the preventive action attribute of the water chemistry program in the LRA also addresses maintaining proper corrosion inhibitor concentrations in the closed-cycle cooling water systems. The staff finds that this additional requirement in the applicant’s chemistry program extends its preventive function to the closed-cycle cooling water systems, and therefore, finds it acceptable.

[Monitoring and Trending] The monitoring and trending attribute in the water chemistry program in GALL is modified by specifying the need for sampling water chemistry on a continuous, daily, weekly, or as needed basis, as indicated by plant operating conditions. The staff finds this modification acceptable because it will improve aging management by closely maintaining controlled water chemistry.

[Acceptance Criteria] The acceptance criteria in the GALL water chemistry program are extended by requiring the water in the closed-cooling water system to maintain concentrations of corrosion inhibitors within the specified limits of EPRI TR-107396. The staff finds this modification acceptable because it will ensure that the corrosion damage to the components in this system will be minimized.

[Operating Experience] The plant operating experience has indicated that over the operating history of the plant, several incidents have occurred which could be attributed to improper water chemistry. These included steam generator (SG) tube leaks, condenser tube leaks, and some resin intrusion into the primary storage tank. However, in all cases, proper corrective actions were implemented to prevent reoccurrence. In addition, the chemistry management of aging effects was continuously upgraded based on plant personnel and industry experience.

Such operating experience has provided feedback to revisions of the EPRI water chemistry guideline document. The staff concluded that the EPRI guideline document, which was developed based on operating experience, has been effective over time with widespread use.

3.0.3.2.3 Conclusions

On the basis of its review and inspection of the applicant's AMP, including the proposed enhancements to the AMP, the staff finds that those portions of the program for which the applicant claims consistency with GALL are consistent with GALL. The staff also reviewed the USAR Supplement for this AMP, and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Therefore, on the basis of its review, the staff concludes that the applicant has demonstrated that the chemistry program will effectively manage aging in the structures and components for which this program is credited so that the intended functions of the associated components and systems will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.0.3.3 Containment Inservice Inspection Program

The applicant described its containment ISI program in Section B.1.3 of the LRA. The applicant credits this program with managing the aging of containment structures and components that are within the scope of license renewal. The staff reviewed the containment ISI program to determine whether the applicant has demonstrated that the program will adequately manage the applicable effects of aging during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.0.3.3.1 Summary of Technical Information in the Application

The LRA states that the FCS containment ISI program is consistent with GALL programs X.S1, "Concrete Containment Tendon Prestress," XI.S1, "ASME Section XI, Subsection IWE," and XI.S2, "ASME Section XI, Subsection IWL." The 10-year containment (IWE and IWL) ISI program plan for FCS, incorporating the examination requirements of Subsection IWE and Subsection IWL of the Code, has been developed and implemented.

As part of the operating experience, the applicant states that inspections of the containment liner have been conducted in accordance with the containment leak rate testing program and the maintenance rule implementation program. Inspections of the tendons and tendon anchorages have been conducted in accordance with technical specifications, the USAR, and plant procedures. Furthermore, the applicant states that the ASME Code, Section XI, Subsection IWL, ISI program incorporates all of the inspection criteria and guidelines of the previous tendon inspection program and is implemented using existing plant procedures. No significant age-related degradation has been identified in the inspections performed.

3.0.3.3.2 Staff Evaluation

LRA Section B.1.3 describes the applicant's containment ISI program. The LRA states that this AMP is consistent with GALL programs X.S1, "Concrete Containment Tendon Prestress," XI.S1, "ASME Section XI, Subsection IWE," and XI.S2, "ASME Section XI, Subsection IWL," with no deviations. The staff also reviewed the USAR Supplement to determine whether it provides an adequate description of the program.

In addition to the review of Section B.1.3 of the LRA, the staff reviewed the relevant portions of Section 3.5, “Aging Management of Containment, Structures, and Component Supports,” of the LRA to correlate the results of the AMR of the containment components with the ISI program described in Section B.1.3 of the LRA.

The applicant’s containment ISI program is consistent with the provisions of GALL programs XI.S1 and XI.S2. Moreover, for the prestressing tendons of the FCS containment, the applicant’s prestressing tendon monitoring program is consistent with GALL program X.S1. In general, the staff considers the use of these GALL programs appropriate and acceptable. Plant-specific implementation is discussed below.

To assess the present condition of the containment liner plate, the staff asked the applicant, in RAI B.1.3-1, to provide a summary of the significant degradations (i.e., metal thinning in excess of 10 percent of the nominal thickness of the metal) discovered during the last inspection of the liner, and a summary of corrective actions taken. By letter dated December 19, 2002, the applicant provided the following response:

> Inspections of the liner performed in May 2001 identified approximately 6 locations of corrosion and loss of material at the base of the liner, between the floor expansion seal and the curb at elevation 994’ 6”. The total area of corrosion was less than 6 square inches. Inspection identified small areas within the corroded areas with a maximum thickness loss of approximately 15%. The minimum thickness measured with [ultrasonic testing] UT was 0.216" compared to a nominal thickness of 0.25". The inspection identified some areas of seal separation from the liner and shrinkage below the curb, which allowed moisture to collect. Repairs were made to recoat the degraded areas of the liner and restore degraded areas of the moisture barrier during the 2002 refueling outage. This included removal of the top portion of the moisture barrier to inspect inaccessible sections of the liner. Only minor surface corrosion was found on the liner extending only 0.125" to 0.25" below the top of the existing joint sealer. FCS plans to reperform the liner inspection during the 2003 refueling outage.

Since the applicant is monitoring the liner condition as part of its ISI program, and maintaining the moisture barrier through periodic inspections, the staff believes that significant liner degradation will be monitored and corrective actions will be taken so that the integrity of the containment, as required by the CLB, will be maintained during the period of extended operation.

For inspection of concrete components of the FCS containment, the applicant is committing to use GALL program XI.S2, “ASME Section XI, Subsection IWL,” during the period of extended operation. The GALL program recognizes the absence of explicit acceptance criteria for concrete components (in Element 6, Acceptance Criteria), and recommends the use of Chapter 5 of American Concrete Institute (ACI) 349.3R. By letter dated February 20, 2003, the staff issued POI-7(b), requesting the applicant to provide information regarding the acceptance criteria to be used for examination of the containment concrete at FCS. By letter dated March 14, 2003, the applicant stated that the FCS containment ISI program meets the requirements of ASME Section XI, Subsection IWL, and is consistent with the criteria specified in GALL program XI.S2, “ASME Section XI, Subsection IWL.” In Appendix B of the March 14, 2003, letter, the applicant provided a copy of the vendor procedure used for the ASME XI, Subsection IWL, inspection performed in 2001. The staff reviewed the information provided in response to POI-7(b) and finds it acceptable because the vendor’s process for examination of concrete surfaces of the FCS containment clearly delineates the responsibility, qualifications, quality control, and examination standards to be used for the examination. POI-7(b) is resolved.

In the 1990s, NRC staff inspections had noted a large amount of grease leakage from the tendons, specifically in the ring-girder areas of the FCS containment. In RAI B.1.3-2, the staff asked the applicant to provide an assessment of such leakage on tendon performance (i.e., absence of corrosion protection and potential degradation of tendon wires) during the period of extended operation, and the effectiveness of the actions taken to alleviate future grease leakage. By letter dated December 19, 2002, the applicant provided the following response:

> Grease leakage noted on the outer containment walls during the 1990's resulted from seal leakage from helical tendon upper grease cans. The leakage characterized as a "large amount" ranges from a few cups to one gallon from a typical volume of more than 50 gallons. This upper seal can leakage has no effect on the long term corrosion of the tendon wires or end attachment, as demonstrated by inspection of the tendon ends when the leaks were repaired. The grease fill procedure was modified to leave additional "head space" for thermal expansion to decrease the number of minor grease leaks on the containment upper helical can seals.
>
> IN 99-10, "Degradation of Prestressing Tendon Systems in Prestressed Concrete Containments," identified examples of tendon degradation due to loss of grease. Our saw tooth construction and unique helical tendon design combine to make many of the aspects of the subject information notice not applicable to FCS. No damage to tendon wires due to lack of grease, corrosion, or other aging effects have been identified during tendon inspections performed at FCS. To investigate the anti-corrosion effectiveness of thin films of grease, OPPD committed to the NRC in 1992 to test a dome tendon that had lost a significant amount of grease. The results of surveillance testing of the dome tendon showed enough grease adheres to the tendon wires to protect them from corrosion even when large grease voids occur. The type of grease was not changed.

The staff believes that the example of wire breakage at the Calvert Cliffs Nuclear Power Plant (described in information notice (IN) 99-10) is applicable to FCS containment tendon wires, and the potential for corrosion-induced wire breakage is a plausible aging effect. However, the applicant is aware of the problem, and since the tendon wires will be monitored during the IWL examinations, the staff finds the applicant's process for addressing this issue acceptable.

The staff reviewed the applicant's operating experience as provided in LRA Section B.1.3 which states that inspections have been conducted of the containment liner, tendons, and tendon anchorages and no age-related degradation of these components was found. The applicant concludes, and the staff agrees, that the plant-specific operating experience indicates that inspections have proved effective in managing the aging effects associated with components within the scope of the containment ISI program.

The applicant provided a summary description of the containment ISI program in Section A.2.6 of the LRA. The staff finds that the summary description contains a sufficient level of information, as required by 10 CFR 54.21(d), and is acceptable.

3.0.3.3.3 Conclusion

On the basis of its review and inspection of the applicant's program, and the applicant's responses to the staff's RAIs, the staff finds that those portions of the program for which the applicant claims consistency with GALL are consistent with GALL. The staff also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Therefore, on the basis of its review, the staff concludes that the applicant has demonstrated that the containment ISI program will effectively manage aging in the structures and components for which this program is credited so that the intended functions of the associated components and systems will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.0.3.4 Flow-Accelerated Corrosion Program

3.0.3.4.1 Summary of Technical Information in the Application

The applicant's FAC program is discussed in LRA Section B.1.5, "Flow-Accelerated Corrosion Program." The applicant states that the program is consistent with GALL program XI.M17, "Flow-Accelerated Corrosion."

This AMP is credited with managing aging effects in components which, although not specifically evaluated, are relying on the aging management of the FAC program in GALL. These components are listed in Tables 3.1-3 and 3.4-3 of the LRA. They are included in reactor and steam and power conversion systems. The components susceptible to FAC are made of carbon and low-alloy steel and are affected by FAC when exposed to the environments of deoxygenated water or saturated steam. The resulting aging effects are caused by loss of material.

The applicant's program for controlling FAC relies on the implementation of the EPRI guidelines contained in NSAC-202L-R2, "Recommendation for an Effective Flow-Accelerated Corrosion Program." The program includes procedures and administrative controls to ensure structural integrity of all carbon or low-alloy lines containing high-energy fluids. The applicant ascertains that all aging effects caused by FAC are properly managed by using predictive codes and inspection procedures which include wall thickness measurements. The applicant uses two codes: CHECWORKS, developed by EPRI, and FACManager which supplements the CHECWORKS code predictions. Using these two codes and performing measurements, the applicant can make timely predictions of loss of material by FAC so that the damaged components can be repaired or replaced before their failure.

3.0.3.4.2 Staff Evaluation

In LRA Section B.1.5, "Flow-Accelerated Corrosion Program," the applicant described its AMP to manage aging effects caused by FAC. The LRA stated that this AMP is consistent with GALL AMP XI.M17, "Flow-Accelerated Corrosion Program," with no deviations. The staff confirmed the applicant's claim of consistency during the AMR inspection. The staff reviewed the applicant's description of the program in the LRA and evaluated the applicant's responses to the staff's RAI B.1.5-1, issued by letter dated October 11, 2002. This RAI requested the applicant to identify the methods used for predicting component degradation by FAC, as discussed in NSAC-202L-R2. By letter dated December 19, 2002, the applicant stated that it had performed a susceptibility analysis to identify components susceptible to degradation by FAC. Components that are suitable for modeling are modeled using CHECWORKS. In addition, all inspection methods are stored in a Microsoft Access-based program called FACManager, which was purchased from a vendor with considerable FAC expertise. FACManager calculates wear using the same equations as CHECWORKS, but calculates wear by a straight line wear over time formula, which is the average wear rate over the components' life (or the time between inspections if the point-to-point method is used). For non-modeled components, FACManager is used to predict component degradation rates. For modeled components, both FACManager and CHECWORKS results are used in determining the component degradation rates.

On the basis of the staff's review, including the applicant's response to RAI B.1.5-1, the staff finds that the applicant's program is consistent with the GALL program. Therefore, the staff determined that there is no need for the staff to review the attributes in the applicant's FAC program, with the exception of plant-specific operating experience. The staff also reviewed the USAR Supplement to determine whether it provides an adequate description of the program.

[Operating Experience] The plant operating experience, described in the LRA, has indicated that on some occasions pipe wall thickness has been found to be below the established screening criteria, and visual inspections have identified through-wall erosion. These deficiencies were documented and the damaged components were repaired or replaced. A major rupture of an extraction steam line occurred in 1997. As a result of that occurrence, the FAC program was upgraded. The current program follows the EPRI guidelines. The staff finds this approach acceptable because, by following current procedures, the applicant ensures that the FAC program will properly manage aging effects due to FAC.

The applicant provided its USAR Supplement for the FAC program in Section A.2.12 of the LRA. The staff reviewed the USAR Supplement and finds that the summary description contains a sufficient level of information, as required by 10 CFR 54.21(d), and is acceptable.

3.0.3.4.3 Conclusions

On the basis of its review and inspection of the applicant's program, the staff finds that those portions of the program for which the applicant claims consistency with GALL are consistent with GALL. The staff also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Therefore, on the basis of its review, the staff concludes that the applicant has demonstrated that the FAC program will effectively manage aging in the structures and components for which this program is credited so that the intended functions of the associated components and systems will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.0.3.5 Inservice Inspection Program

3.0.3.5.1 Summary of Technical Information in the Application

The applicant's ISI program is discussed in LRA Section B.1.6, "Inservice Inspection Program." The applicant states that the program is consistent with GALL programs XI.M1, "ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD," and XI.S3, "ASME Section XI, Subsections IWF." The applicant also states that the scope of the FCS ISI program includes those plant-specific components identified in Tables 3.1-2 and 3.2-3 of the LRA for which the ISI program is identified as an AMP.

As part of the operating experience, the applicant states that the FCS ISI program has been effective in managing the aging effects of components. No significant age-related degradation has been identified in the inspections performed.

3.0.3.5.2 Staff Evaluation

The applicant states that the program is consistent with GALL program XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and XI.S3, "ASME Section XI, Subsections IWF," with no deviations. The staff confirmed the applicant's claim of consistency during the AMR inspection. The staff concludes that the applicant's program is consistent with the GALL program. There is no need, therefore, for the staff to review the attributes in the applicant's ISI program, with the exception of plant-specific operating experience. The staff also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

[Operating Experience] The plant operating experience, described in the LRA, has indicated that there was no significant age-related degradation identified through inservice inspection of components performed during the past inspection intervals. The FCS ISI program has been effective in managing the aging effects of those components and their integral supports identified in Tables 3.1-2 and 3.2-3 of the LRA for which the ISI program is identified as an AMP. The staff, therefore, has determined that the applicant's ISI program will adequately manage the aging effects in the components identified in the tables during the period of extended operation.

3.0.3.5.3 Conclusion

On the basis of its review and inspection of the applicant's program, the staff finds that those portions of the program for which the applicant claims consistency with GALL are consistent with GALL. The staff also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Therefore, on the basis of its review, the staff concludes that the applicant has demonstrated that the ISI program will effectively manage aging in the structures and components for which this program is credited so that the intended functions of the associated components and systems will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.0.3.6 Boric Acid Corrosion Prevention Program

3.0.3.6.1 Summary of Information in the Application

The applicant's BAC prevention program is discussed in LRA Section B.2.1, “Boric Acid Corrosion Prevention Program.” The applicant states that the program is consistent with GALL program XI.M10, “Boric Acid Corrosion,” with several enhancements which will be made prior to the period of extended operation.

The AMP is credited with managing the aging effects in the systems carrying water containing boric acid. The program will manage the aging effects in the components which either are not evaluated in GALL, or, although not specifically evaluated, are relying on the AMPs in GALL.

These components are listed in Tables 3.1-2, 3.1-3, and 3.3-3 of the LRA. They are included in the reactor and auxiliary systems. The components are made of carbon steel, low-alloy steel, cast iron, cadmium plated steel, galvanized steel, and copper alloys. When exposed to leakage of boric acid, the resulting aging effect is loss of material.

The program relies on implementation of the recommendations of NRC Generic Letter (GL) 88-05 to monitor the condition of the reactor coolant pressure boundary for boric acid leaks. Periodic visual inspections of adjacent structures, components, and supports for evidence of leakage and corrosion are the elements of the program.

3.0.3.6.2 Staff Evaluation

In LRA Section B.2.1, “Boric Acid Corrosion Prevention Program,” the applicant described its AMP to manage aging effects due to boric acid leakage. The LRA stated that this AMP is consistent with GALL AMP XI.M10, “Boric Acid Corrosion,” with enhancements that will be made prior to the period of extended operation. The enhancements increase the scope of inspections and provide specific guidance to the inspectors. The staff confirmed the applicant’s claim of consistency during the AMR inspection.

The inclusion of the information discussed above causes changes in some attributes of the GALL BAC prevention program. Therefore, the staff reviewed this AMP against only those attributes of the applicant’s program which deviate from the attributes of the GALL’s BAC program, defined in BTP RLSB-1, found in Appendix A of the SRP-LR. The staff also reviewed the USAR Supplement to determine whether it provides an adequate description of the program.

[Scope of Program] The applicant added to the scope of the GALL BAC program, specific guidance for inspection of the components, structures, and electrical components where boric acid may have leaked. It also added the need for inspecting the fuel pool cooling and waste disposal systems. The staff finds this acceptable because these additional inspections will make the program more comprehensive, and improve the management of aging effects in the components potentially exposed to boric acid leaks.

[Parameters Monitored or Inspected] The applicant’s BAC prevention program specifies the parameters monitored and inspected, with an enhancement to include the spent fuel pool cooling and waste disposal systems to the scope of the program. The staff finds this acceptable because this will broaden the program and enhance the program for managing the existing aging effects.

[Monitoring and Trending] The monitoring and trending attribute in the applicant’s program will be enhanced by implementing specific guidance to require maintenance personnel to report boric acid leakage to the BAC prevention program engineer. These procedures will improve the way the plant systems containing boric acid are monitored and trended, and will contribute to better management of the aging effects caused by boric acid corrosion. Therefore, the staff finds this enhancement acceptable.

[Operating Experience] The plant operating experience included severe boric acid corrosion of pump studs, which prompted the applicant to introduce significant improvement to its BAC prevention program. The staff agrees with the applicant that the current program routinely identifies and corrects borated water leakage in the RCS and other systems carrying borated water, and adequately manages aging effects caused by boric acid corrosion.

The applicant provided its USAR Supplement for the BAC prevention program in Section A.2.3 of the LRA. The staff reviewed the USAR Supplement and finds that the summary description contains a sufficient level of information, as required by 10 CFR 54.21(d), and is acceptable.

The staff is currently reviewing the issues associated with NRC Bulletin 2002-01. This bulletin was issued as a result of a control rod drive mechanism nozzle cracking event at Davis Besse, which resulted in severe degradation of the reactor vessel head due to exposure to concentrated boric acid. To date, all licensees (except Davis Besse) have responded to the bulletin, providing information about their boric acid corrosion control programs. Any future regulatory actions that may be required as a result of those reviews will be addressed by the staff in a separate regulatory action. This is considered a current operating issue and will be handled as such. The staff will resolve this issue in accordance with 10 CFR 54.30 outside of the license renewal process.

3.0.3.6.3 Conclusions

On the basis of its review and inspection of the applicant's program, the staff finds that those portions of the program for which the applicant claims consistency with GALL are consistent with GALL. In addition, the staff has reviewed the enhancements to the GALL program and finds that the applicant's program provides for adequate management of the aging effects for which the program is credited. The staff also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Therefore, on the basis of its review, the staff concludes that the applicant has demonstrated that the BAC prevention program will effectively manage aging in the structures and components for which this program is credited so that the intended functions of the associated components and systems will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.0.3.7 Cooling Water Corrosion Program

3.0.3.7.1 Summary of Technical Information in the Application

The applicant's cooling water corrosion program is discussed in LRA Section B.2.2, "Cooling Water Corrosion Program." The applicant states that the program is consistent with GALL program XI.M20,"Open-Cycle Cooling Water System," modified by moving the reference to external coatings to Section B.3.3, "General Corrosion of External Surfaces Program," in the LRA. The cooling water corrosion program is also consistent with the non-chemistry related portions of GALL program XI.M21, "Closed-Cycle Cooling Water System," modified by removing from the license renewal commitments reference to (1) fluid flow, which is an active function, and (2) testing the systems performing active functions.

This AMP is credited with managing aging effects in the open-cycle and closed-cycle cooling water systems.

The cooling water corrosion program will also manage the aging effects in the components which are either not evaluated in GALL, or, although not specifically evaluated, are relying on the AMP in GALL. These components are listed in Tables 3.2-2, 3.3-2, and 3.3-3 of the LRA. They are included in the sections of the LRA addressing the ESF and auxiliary systems. These components are made from Alloy 600, brass, bronze, copper and copper alloy, nickel-based alloy, carbon and stainless steel, and cast iron. They are exposed to the environments of corrosion-inhibited treated water, oxygenated or deoxygenated treated water, and raw water.

The resulting aging effects are caused by cracking and by loss of material due to crevice, pitting, galvanic, general, and microbiologically-influenced corrosion, and biofouling. The aging management activities of the applicant's cooling water corrosion program is based on the EPRI guidelines in TR-107396.

3.0.3.7.2 Staff Evaluation

In LRA Section B.2.2, "Cooling Water Corrosion Program," the applicant described its AMP to manage aging effects due to corrosion. The LRA stated that this AMP is consistent with GALL program XI.M20,"Open-Cycle Cooling Water System," modified by moving the reference to external coatings to Section B.3.3, "General Corrosion of External Surfaces Program," in the LRA. The cooling water corrosion program is also consistent with the non-chemistry related portions of GALL program XI.M21, "Closed-Cycle Cooling Water System," modified by removing from the license renewal commitments reference to (1) fluid flow, which is an active function, and (2) testing the systems performing active functions. The staff confirmed the applicant's claim of consistency during the AMR inspection. The chemistry-related portions of XI.M21 are addressed in the FCS chemistry program (LRA Section B.1.2) which is evaluated by the staff in Section 3.0.3.2 of this SER.

The deviations of the program caused changes in some attributes of the GALL open-cycle and closed-cycle cooling water system programs. Therefore, the staff reviewed this AMP against only those attributes of the applicant's programs which deviate from the attributes of the GALL's open- and closed-cycle cooling water system programs, as defined in BTP RLSB-1, found in Appendix A of the SRP-LR. The staff also reviewed the USAR Supplement to determine whether it provides an adequate description of the program.

[Scope of Program] The scope of the applicant's cooling water corrosion program consists of the scope of GALL program, augmented by additional inspections of various raw water and closed-cycle cooling system components based on a susceptibility evaluation. The staff finds this acceptable because including these additional inspections makes the program more comprehensive and ensures better management of the aging effects.

[Preventive or Mitigative Actions] The preventive actions attribute in the applicant's program is modified by removing the chemistry-related portions in the GALL's closed-cycle cooling water program. The preventive actions specified in the removed portions address the need for maintaining corrosion inhibitor concentrations within specified limits, and monitoring and controlling cooling water chemistry. The staff finds this modification acceptable because these preventive actions are addressed in the applicant's chemistry program.

[Parameters Monitored or Inspected] The parameters monitored or inspected attribute in the applicant's program is modified by removing the need for monitoring and inspecting external coatings in the GALL's open-cycle cooling water system and relaxing the requirements for the frequency of monitoring in the closed-cycle cooling water system. The staff finds this acceptable because external coatings are addressed in the applicant's general corrosion of external surfaces program, and the need for specific monitoring frequency is not required by the EPRI guidelines on which the program is based.

[Detection of Aging Effects] The detection of aging effects attribute in the applicant's program is modified by removing the need for detecting aging effects caused by defective external protective coatings in the open-cycle cooling water system and by the addition, to both the open- and closed-cycle cooling water systems of more component inspections based on a susceptibility evaluation. The detection of aging effects caused by defective external protective coatings is addressed in the applicant's general corrosion of external surfaces program, and additional inspections will improve detection of the aging effects. Therefore, the staff finds the deviation from the GALL program to be acceptable.

[Monitoring and Trending] The monitoring and trending attribute is required to demonstrate system capability to remove heat from the cooling water. In the applicant's program, this consists of modifying the GALL attribute to add inspections of various components in the open-cycle and closed-cycle cooling water systems, based on evaluations of their susceptibility. Also, the applicant moved the monitoring of the conditions of the surface coatings to its general corrosion of external surfaces program. The staff finds the modification of the monitoring and trending attribute of the applicant's program to be acceptable because it includes additional inspections, and the monitoring and trending functions removed from the GALL programs are addressed in other programs.

[Operating Experience] The plant operating experience has identified the need for some component repair and replacement due to corrosion and cracking in the component cooling water and raw water environments. Appropriate long-term corrective actions were implemented based on these experiences. As a result, the staff agrees that the current cooling water corrosion program ensures that the aging effects will be properly managed.

The applicant provided its USAR Supplement for the cooling water corrosion program in Section A.2.8 of the LRA. The staff reviewed the USAR Supplement and finds that the summary description contains a sufficient level of information, as required by 10 CFR 54.21(d), and is acceptable.

3.0.3.7.3 Conclusions

On the basis of its review and inspection of the applicant's program, the staff finds that those portions of the program for which the applicant claims consistency with GALL are consistent with GALL. In addition, the staff has reviewed the clarifications, exceptions, and enhancements to the GALL program and finds that the applicant's program provides for adequate management of the aging effects for which the program is credited. The staff also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Therefore, on the basis of its review, the staff concludes that the applicant has demonstrated that the cooling water corrosion program will effectively manage aging in the structures and components for which this program is credited so that the intended functions of the associated components and systems will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.0.3.8 Fatigue Monitoring Program

The applicant described its fatigue monitoring program (FMP) in Section B.2.4 of the LRA. This program monitors the number of transients that were assumed in the fatigue design. The applicant credits this program with managing the aging of RCS and some Code Class 2 and 3 structures and components that are within the scope of license renewal and subject to an AMR. The staff reviewed the FMP to determine whether the applicant has demonstrated that the program will adequately manage the applicable effects of aging during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.0.3.8.1 Summary of Technical Information in the Application

The LRA states that the FMP is consistent with GALL program X.M1, “Metal Fatigue of Reactor Coolant Pressure Boundary,” except that the program will also be used for some Class 2 and 3 components that are subject to fatigue as an aging effect requiring management (AERM). The LRA states that the current program will be enhanced to include the pressurizer surge line bounding locations and some Class 2 and 3 components. In addition, the applicant indicates that site-specific calculations will be performed to address environmental fatigue concerns identified in NUREG/CR-6260, "Application of NUREG/CR-5999, 'Interim Fatigue Curves to Selected Nuclear Power Plant Components'," dated March 1995. Under operating experience, the LRA states that there have been no failures related to thermal fatigue; however, two enhancements to the program resulted from site corrective actions. The first related to cycle counting requirements for the chemical and volume control system (CVCS). The second related to thermal fatigue of small-bore piping. The LRA also describes actions (re-analyses and/or replacement) that will be taken for components that are expected to exceed their fatigue limits before the period of extended operation (e.g., the pressurizer surge line and the primary sampling system).

3.0.3.8.2 Staff Evaluation

LRA Section B.2.4 describes the applicant’s AMP to manage fatigue of RCS components. The LRA states that this AMP is consistent with GALL AMP X.M1, “Metal Fatigue of Reactor Coolant Pressure Boundary.” The staff confirmed the applicant’s claim of consistency during the AMR inspection. Furthermore, the staff reviewed the program enhancements and the applicant’s justifications for the enhancements to determine whether the AMP is adequate to manage the aging effects for which it is credited. The staff also reviewed the USAR Supplement to determine whether it provides an adequate description of the revised program.

The applicant indicated the scope of the FMP includes those plant-specific components identified in Table 3.1-2 of the LRA for which the FMP is identified as an AMP. However, Table 3.1-2 only lists the FMP as an AMP for the reactor vessel internals flow skirt. In RAI B.2.4-1, the staff requested that the applicant clarify the scope of the components covered by the FMP. In its December 12, 2002, response to RAI B.2.4-1, the applicant indicated that the statement should have referred to the components identified in Section 4.3 of the LRA. Section 4.3 of the LRA addresses metal fatigue of reactor coolant pressure boundary components. The staff considers the applicant’s clarification acceptable.

The applicant indicated that the scope of the program was enhanced to include the pressurizer surge line bounding locations. The scope of the program specified in GALL program X.M1 includes metal components of the reactor coolant pressure boundary. The staff finds that inclusion of the pressurizer surge line locations is consistent with the GALL. The applicant also indicated that the scope of the program was enhanced to include additional Class 2 and 3 components. These components include portions of the primary sampling system. As discussed in Section 4.3 of this SER, the staff finds the inclusion of these Class 2 and 3 components in the FMP acceptable.

The applicant discussed the operating experience at FCS that led to enhancements to the FMP. The LRA indicates that an assessment of the operation of the CVCS was performed to ensure that the appropriate transients were monitored by the FMP. In RAI B.2.4-2, the staff requested that the applicant describe the enhancements to the FMP that resulted from this assessment. The applicant's December 19, 2002, response indicated that additional cycle counting requirements for CVCS transients, as discussed in Section 4.3.1 of the LRA, were incorporated in the monitoring procedure. The staff finds the applicant's clarification acceptable. The staff discussion of the CVCS transients is contained in Section 4.3 of this SER.

The applicant indicated that the program would be enhanced to include site-specific calculations to address environmental fatigue concerns identified in NUREG/CR-6260. The program specified in GALL X.M1 requires that the program include an evaluation of the impact of the reactor coolant environment on the components identified in NUREG/CR-6260. Therefore, the applicant's program is consistent with the GALL Report. The applicant completed the evaluation of the components identified in NUREG/CR-6260. Section 4.3 of this SER contains additional discussion of the applicant's evaluation of these components.

The applicant provided its USAR Supplement for the FMP program in Section A.2.10 of the LRA. The staff reviewed the USAR Supplement and finds that the summary description contains a sufficient level of information, as required by 10 CFR 54.21(d), and is acceptable.

3.0.3.8.3 Conclusions

On the basis of its review and inspection of the applicant's program, the staff finds that those portions of the program for which the applicant claims consistency with GALL are consistent with GALL. In addition, the staff has reviewed the enhancements to the GALL program and finds that the applicant's program provides for adequate management of the aging effects for which the program is credited. The staff also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Therefore, on the basis of its review, the staff concludes that the applicant has demonstrated that the FMP will effectively manage aging in the structures and components for which this program is credited so that the intended functions of the associated components and systems will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.0.3.9 Fire Protection Program

The applicant described its fire protection program (FPP) in Section B.2.5 of the LRA. The applicant credits this program with managing the aging of fire protection system components that are within the scope of license renewal and subject to an AMR. The staff reviewed the FPP to determine whether the applicant has demonstrated that the program will adequately manage the applicable effects of aging during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.0.3.9.1 Summary of Technical Information in the Application

The LRA states that the FPP is consistent with GALL programs XI.M26, “Fire Protection,” and XI.M27, “Fire Water System,” with the following exception. In the flow tests of portions of the sprinkler system that are not routinely subjected to flow, the applicant proposed to perform the flow tests at a slightly lower pressure than the normal system operating pressure. The LRA also lists several enhancements that will be made to the current plant program.

For operating experience, the LRA states that the routine visual inspections of fire barriers have proven effective in identifying material degradation and damage, and that inspections have adequately managed the fire barrier walls, ceilings, doors, and floors. The LRA states that through-wall leakage of seamed fire protection system piping has been identified at FCS, and routine walkdowns and piping inspections have been implemented to identify early stages of pressure boundary degradation. Further, yard fire hydrants, fire dampers, sprinklers, and nozzles, as well as halon system piping and tanks, have been adequately managed.

3.0.3.9.2 Staff Evaluation

In LRA Section B.2.5, “Fire Protection Program,” the applicant described its AMP to manage the aging of structures and components in the fire protection system. The LRA states that this AMP is consistent with GALL programs XI.M26, “Fire Protection,” and XI.M27, “Fire Water System,” with one exception. The exception is that, in the flow tests of portions of the sprinkler system that are not routinely subjected to flow, the applicant proposed to perform the flow tests at a slightly lower pressure than the normal system operating pressure. The staff confirmed the applicant’s claim of consistency during the AMR inspection. Furthermore, the staff reviewed the deviation and its justification to determine whether the AMP, with the deviation, remains adequate to manage the aging effects for which it is credited. The staff also reviewed the USAR Supplement to determine whether it provides an adequate description of the revised program.

GALL program XI.M26 includes a fire barrier inspection program and a diesel-driven fire pump inspection program. The fire barrier inspection program requires periodic visual inspection of fire barrier protection seals, fire barrier walls, ceilings, and floors, and periodic visual inspection and functional tests of fire-rated doors to ensure that their operability is maintained. The diesel-driven fire pump inspection program requires that the pump be periodically tested to ensure that the fuel supply line can perform its intended function. The AMP also includes periodic inspection and testing of the halon/carbon dioxide fire suppression system.

GALL program XI.M27 applies to water-based fire protection systems that consist of sprinklers, nozzles, fittings, valves, hydrants, hose stations, stand pipes, water storage tanks, and above-ground and underground piping and components that are tested in accordance with the applicable National Fire Protection Association (NFPA) codes and standards. Such testing assures the minimum functionality of the systems. Also, these systems are normally maintained at required operating pressure and monitored such that loss of system pressure is immediately detected and corrective actions initiated. In addition to NFPA codes and standards, which do not currently contain programs to manage aging, those portions of the fire protection sprinkler system, which are not routinely subjected to flow, are to be subjected to full flow tests at the maximum design flow and pressure before the period of extended operation (and at not more than 5-year intervals thereafter). In addition, a sample of sprinkler heads is to be inspected by using the guidance of NFPA-25, Section 2.3.3.1. This NFPA section states 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." It also contains guidance to perform this sampling every 10 years after the initial field service testing. Finally, portions of fire protection suppression piping located above ground and exposed to water are disassembled and visually inspected internally once every refueling outage. The purpose of full-flow testing and internal visual inspections is to ensure that corrosion, MIC, or biofouling aging effects are managed such that the system function is maintained.

During the staff's audit conducted from January 6-10, 2003, and from January 20-23, 2003, the staff verified that the scope of the FPP includes the components identified in GALL programs XI.M26 and XI.M27.

The clarification to GALL is related to program XI.M27, Element 2, *"Preventative Action*." The GALL specifies that portions of the fire protection sprinkler system, which are not routinely subjected to flow, are to be subjected to full flow tests at the maximum design flow and pressure. The FCS USAR, Table 9.11-3, directs flow testing to be performed using a clean water source. The applicant stated that the demineralized water booster pumps or Blair City water are used for flow testing at pressures slightly lower than the normal system operating pressure. This is not consistent with GALL; however, the applicant stated that both the pressure and resulting flow are sufficient to effectively entrain any sediment and adequately flush and flow test the sprinkler system piping. The staff finds it appropriate to use a clean water source to flush the fire protection sprinkler system, and finds it acceptable for the applicant to flush/flow test the system at a slightly lower pressure in order to use the clean water source. Therefore, the staff finds the proposed deviation to be acceptable.

Chapter 3 of the LRA identifies those components for which the FPP is identified as an AMP. The staff verified that the components in Chapter 3 of the LRA to which the program applies are consistent with the intent of GALL programs X1.M.26 and X1.M.27.

The enhancements to the applicant's program that are identified in the LRA were also reviewed, and the applicant was requested to provide additional information relating to the staff's concerns. In RAI B.2.5-1, Item 1, the staff asked the applicant to confirm that the guidance which will be added to the diesel fuel pump maintenance procedure will ensure that the diesel-driven fire pump is under observation during performance tests (e.g., flow and discharge tests, sequential starting capability tests, and controller function tests) for detecting any degradation of the fuel supply line. In its December 19, 2002, response, the applicant stated that the procedure enhancements would ensure that the diesel fire pump is under direct observation during performance testing. The staff finds the applicant's response reasonable and acceptable and RAI B.2.5-1, Item 1 is resolved.

In RAI B.2.5-1, Item 2, the staff asked the applicant to confirm that (1) the guidance which will be added to halon and fire damper inspection procedures will include periodic visual inspection and function tests at least once every six months to examine signs of degradation of the halon/carbon dioxide fire suppression system, (2) the suppression agent change pressure will be monitored in the test, (3) the material conditions that may affect the performance of the system, such as corrosion, mechanical damage, or damaged dampers, are observed during these tests, and (4) the inspection will be performed at least once every month to verify that the extinguishing agent supply valves are open, and the system is in automatic mode. By letter dated December 19, 2002, the applicant provided the following response:

> The enhancement identified in the license renewal application for Fire Protection Program (B.2.5) was to add specific guidance to the halon and fire damper inspection procedures to inspect halon system components and fire dampers for corrosion, mechanical, and physical damage. This enhancement will be implemented prior to the period of extended operation.
>
> Halon and fire damper inspection procedures include periodic visual inspections and functional tests every 18-months to examine signs of degradation of the halon fire suppression system. Although the suppression agent charge pressure is checked on a semi-annual basis and inspections are performed on a monthly basis that verify that the extinguishing agent supply valves are open and that the system is in automatic mode, these activities are not required for license renewal. Per interim staff guidance, these activities are not aging management related since the valve line-up inspection, charging pressure inspection, and automatic mode of operation verification are operational activities pertaining to system or component configurations or properties that may change.

The staff finds the applicant's response acceptable because it conforms to the staff position described in Interim Staff Guidance (ISG)-04, "Aging Management of Fire Protection Systems for License Renewal." (Letter from D. Matthews to A. Nelson and D. Lochbaum, dated December 3, 2002, ML023440137.)

During the staff's audit conducted from January 6-10, 2003, and from January 20-23, 2003, the staff reviewed the applicant's inspection frequency for the halon fire suppression system. GALL program XI.M26 prescribes a 6-month frequency for the functional tests of the halon system. The staff noted that the following were not inspected on a six-month frequency.

- Visual and functional tests of the control room walk-in cabinet, cable spread room, and switchgear room are conducted on an 18-month frequency.
- The fire protection system halon system air-flow test, which verifies that each halon nozzle and associated piping is unobstructed, is conducted on a three-year frequency.
- Fire dampers are inspected on an 18-month frequency.

Operating experience has shown that these inspection frequencies are adequate to ensure the system maintains its function. The staff finds that these frequencies are acceptable based on the applicant's operating experience.

In RAI B.2.5-1, Item 3, the staff asked the applicant to confirm that (1) the specific guidance which will be added related to the fire door inspections will ensure that hollow metal fire doors are visually inspected at least once bi-monthly for holes in the skin of the door, (2) fire door clearances are also checked at least once bi-monthly as part of an inspection program, and (3) function tests of fire doors are performed daily, weekly, or monthly (which may be plant-specific) to verify the operability of automatic hold-open, release, closing mechanisms, and latches. By letter dated December 19, 2002, the applicant provided the following response.

> The enhancement identified in the license renewal application for Fire Protection Program (B.2.5) was to add specific guidance to the fire door inspection procedures to inspect for wear and missing parts. This enhancement will be implemented prior to the period of extended operation.
>
> Inspections of fire doors for holes, clearances, and proper operation of opening, latching, and closure mechanisms within the specified frequencies are currently included in the FCS Fire Protection Program with the exception of the frequency of inspection for fire door clearances. A revision to the inspection frequency for fire door clearances is currently in process to meet the bimonthly requirement.

The staff finds the applicant's response acceptable because it is consistent with GALL.

The staff has proposed a revision to GALL program XI.M27 related to inspections for wall thinning of piping due to corrosion. The revised staff position states that each time the system is opened, oxygen is introduced into the system, thus accelerating the potential for general corrosion. Therefore, the staff has recommended that a non-intrusive means of measuring wall thickness, such as ultrasonic inspection, be used to detect this aging effect. The staff recommends that, in addition to a baseline ultrasonic inspection of the fire protection piping that is performed before exceeding the current licensing term, the applicant should perform ultrasonic inspections at 10-year intervals thereafter. In RAI B.2.5-2, the staff asked the applicant whether the inspection criteria for the FPP conforms with the staff position outlined above. By letter dated December 12, 2002, the applicant responded that enhancements will be made to the FPP prior to the period of extended operation to implement the interim staff guidance. The staff finds this acceptable, and RAI B.2.5-2 is resolved.

The program description for XI.M27 states that underground piping is to be managed by the program. However, the program does not address aging management of underground piping. To evaluate whether the applicant's FPP will adequately manage aging of underground piping in the fire water system, the staff asked the applicant (RAI B.2.5-3) to describe the environmental and material conditions that exist on the interior surface of below-grade fire protection piping, to demonstrate how the above-ground piping conditions can be extrapolated to determine the below-ground piping conditions, and to describe how the FPP will manage aging of underground piping. RAI B.2.5-3 also asked the applicant to demonstrate how underground piping will be adequately managed during the period of extended operation to assure maintenance of the component intended function if a meaningful extrapolation cannot be made. By letter dated December 19, 2002, the applicant provided the following response:

> Portions of the Fire Protection System piping that are underground are made of asbestos-cement or cast iron with a cement lining. For these materials, an aging management evaluation determined that aging management is not required because the interior of these pipes is not exposed to an aggressive environment (pH < 5.5, sulfates > 1500 ppm, and chlorides > 500 ppm). Under normal conditions, the system is filled with potable water whose pH, sulfate, and chloride content is within these limits. If untreated raw water is injected into the system, the system is flushed and refilled with potable water. The cement lining was installed in accordance with American Water Works Association (AWWA) Standard C104, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water. The minimum lining thickness for the size of pipe at FCS is 1/16" and meets the requirements of ASTM C150. The lining was applied to the pipe at the time of manufacture. The cement lining of cast iron piping provides it with an added feature to prevent the loss of material of the base metal due to corrosion. The cement lining also prevents internal buildup of turbucles that would contribute to degradation of the pipe flow characteristics. In addition to the inspection activities, the testing features of the Fire

> Protection Program provide assurance that the entire system can perform its intended function. A visual as-found inspection performed on a section of the FP piping during modification/maintenance work in May of 2000 identified that the internal surfaces of the underground piping were clean with a little oxidation on the piping wall.

The staff finds the applicant's response to be reasonable and acceptable.

In RAI B.2.5-4, the staff informed the applicant about its concern that the applicant's FPP may not adequately manage aging of coatings in steel structures, since neither XI.M26 nor XI.M27 address coatings. On this basis, the staff asked the applicant to identify any steel structures within the scope of license renewal and subject to an AMR which depend on coatings to protect the steel structures from age-related degradation, and to describe the AMP and activities that manage the aging effects for the coatings. In its December 19, 2002, response, the applicant stated that no steel structures within the scope of license renewal that are subject to an AMR depend on coatings to protect the steel structure from age-related degradation. The staff finds the applicant's response acceptable to resolve the concern.

In RAI B.2.5-5, Item 2, the staff asked the applicant to clarify the schedule for testing and replacement of sprinkler heads. NFPA-25, 1999 Edition, Section 2.3.3.1, "Sprinklers," states, "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." NFPA-25 also contains guidance to perform this sampling every 10 years after the initial field service testing. The 50-year service life of sprinkler heads does not necessarily equal the 50^{th} year of operation in terms of licensing. The service life is defined from the time the sprinkler system is installed and functional. In most cases, sprinkler systems are in place several years before the operating license is issued. However, sprinkler systems in some plants may have been installed after the plant was placed in operation. The staff interpretation, in accordance with NFPA-25, is that sprinkler head testing should be performed at year 50 after installation, not at year 50 of plant operation, with subsequent sprinkler head testing every 10 years thereafter. This is reflected in GALL program XI.M27. In its December 19, 2002, response to RAI B.2.5-5, the applicant clarified that the testing schedule would be based on the sprinkler inservice date, and the inservice date of 1972 would be used to determine the schedule. The staff finds the applicant's response acceptable because it conforms to the staff position.

The staff reviewed the summary description of the FPP in Appendix A of the LRA. The staff finds that the information in the USAR Supplement provides an adequate summary of the program activities as required by 10 CFR 54.21(d).

3.0.3.9.3 Conclusion

On the basis of its review and inspection of the applicant's program, the staff finds that those portions of the program for which the applicant claims consistency with GALL are consistent with GALL. In addition, the staff has reviewed the clarification to the GALL program and finds that the applicant's program provides for adequate management of the aging effects for which the program is credited. The staff also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Therefore, on the basis of its review and the applicant's commitments discussed above, the staff concludes that the applicant has demonstrated that the FPP will effectively manage aging in the structures and components for which this program is credited so that the intended functions of the associated components and systems will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.0.3.10 Periodic Surveillance and Preventive Maintenance Program

3.0.3.10.1 Summary of Technical Information in the Application

The PS/PMP, credited for license renewal, is a select subset of activities performed under the FCS surveillance test and preventive maintenance programs. The purpose of the surveillance test program is to complete all surveillance requirements set forth in the FCS technical specifications, FPP, and off-site dose calculation manual (ODCM). The purpose of the preventive maintenance program is to prevent or minimize equipment breakdown and to maintain equipment in a satisfactory condition for normal and/or emergency use. The program is accomplished by performing periodic inspections and tests that are relied on to manage aging of system components and structures that are not evaluated as part of other AMPs.

The applicant states that the purpose of the PS/PMP is to prevent or minimize equipment breakdown and to maintain equipment in a satisfactory condition for normal and/or emergency use. The activities performed under the PS/PMP can be described in the following general categories; component inspections for degradation (i.e., valve internals, ventilation dampers, intake structure screens, manhole covers, etc.), lube oil analysis, and visual observations (i.e., operations logs, spent fuel pool level monitoring, etc.). In addition, the preventive maintenance tasks of performing replacement of components identified as "periodically replaced" during the scoping, screening, and AMR process are incorporated into this program.

3.0.3.10.2 Staff Evaluation

In LRA Section B.2.7, "Periodic Surveillance and Preventive Maintenance Program," the applicant described its AMP to manage the effects of aging of system components and structures that are not evaluated as part of other AMPs. This AMP is not consistent with a GALL AMP. Therefore, the staff reviewed this AMP against the 10 program elements defined in BTP RLSB-1, found in Appendix A of the SRP-LR. The staff also reviewed the USAR Supplement to determine whether it provides an adequate description of the program.

[Program Scope] The FCS PS/PMP provides for periodic inspection and testing of components in the following systems and structures:

- auxiliary building
- auxiliary building HVAC
- auxiliary feedwater
- chemical and volume control
- component cooling
- containment
- containment ventilation
- control room HVAC and toxic gas monitoring
- diesel generator lube oil

- duct banks
- emergency diesel generators
- fire protection
- fuel handling equipment/heavy load cranes
- intake structure
- liquid waste disposal
- containment penetration and system interface components for non-critical quality element (CQE) systems
- control area chilled water
- reactor coolant
- safety injection and containment spray
- ventilating air

The staff found that the scope of the PS/PMP is acceptable because it is comprehensive in that it includes the systems, structures, and major components that may be affected by equipment breakdown.

[Preventive or Mitigative Actions] The applicant states that the PS/PMP includes periodic refurbishment or replacement of components, which could be considered to be preventive or mitigative actions. The staff finds the applicant's approach acceptable because routine replacement or timely refurbishment of components will prevent or minimize equipment breakdown and will maintain equipment in a condition that will enable it to perform its intended function during the period of extended operation.

[Parameters Inspected or Monitored] The applicant states that inspection and testing activities performed under the program monitor parameters such as surface condition, loss of material, presence of corrosion products, signs of cracking, and presence of water in oil samples. The staff finds that the parameters inspected or monitored provide symptomatic evidence of potential degradation for timely replacement of components to prevent equipment failure and, therefore, are acceptable.

[Detection of Aging Effects]   The applicant states that the PS/PMP testing activities provide for periodic component inspections and testing to detect the following aging effects and mechanisms:

- change in material properties
- loss of material - general corrosion
- cracking
- loss of material - pitting corrosion
- fouling
- loss of material - pitting/ crevice/general corrosion
- loss of material - wear
- loss of material - crevice corrosion
- separation
- loss of material - fretting

The LRA states that the extent and schedule of the inspections and testing assures detection of component degradation prior to the loss of component intended functions. It also states that established techniques, such as visual inspections and dye penetrant testing, are used. The staff finds that the techniques used by the applicant to detect aging effects are consistent with accepted engineering practice and, therefore, satisfy this program element.

[Monitoring and Trending] The applicant states that the PS/PMP testing activities provide for monitoring and trending of age-related degradation. Inspection intervals are established to provide for timely detection of component degradation. Inspection intervals are dependent on the component material and environment and take into consideration industry and plant-specific operating experience and manufacturers' recommendations.

The LRA states that the PS/PMP includes provisions for monitoring and trending with the stated intent of identifying potential failures or degradation and making adjustments to ensure components remain capable of performing their functions. The PS/PMP review and update guidelines are provided that include adjustment of the PS/PMP tasks and frequencies based on the as-found results of previous performance of the PS/PMP. In particular, responsible system engineers are required to periodically review the results of preventive maintenance and recommend changes based on these reviews. The PS/PMP includes guidance to assist the system engineers in achieving efficient and effective trending.

The staff finds that the overall monitoring and trending techniques proposed by the applicant are acceptable because inspections, replacements, and sampling activities will effectively manage the applicable aging effects.

[Acceptance Criteria] The applicant states that the PS/PMP acceptance criteria are defined in the specific inspection and testing procedures. The LRA further states that FCS confirms component integrity by verifying the absence of the aging effect or by comparing applicable parameters to limits based on the applicable intended function(s) as established by the plant design basis. This is acceptable to the staff in the absence of code-specified acceptance criteria.

[Operating Experience] The applicant states that the PS/PMP activities have been in place at FCS since the plant began operation. These activities have demonstrated a history of detecting damaged or degraded components and, thereby, requiring repair or replacement in accordance with the site corrective action process.

With few exceptions, age-related degradation adverse to component intended functions have been discovered, and corrective actions have been taken prior to loss of intended function. The staff finds that the applicant's operating experience supports the conclusion that the program will adequately manage the aging effects in the specified systems, structures, and components.

The applicant provided its USAR Supplement for the PS/PMP in Section A.2.18 of the LRA. The staff reviewed the USAR Supplement and finds that the summary description contains a sufficient level of information to satisfy 10 CFR 54.21(d), and is acceptable.

3.0.3.10.3 Conclusion

On the basis of its review and inspection of the applicant's program, the staff finds that the program adequately addresses the ten program elements defined in BTP RLSB-1, found in Appendix A.1 of the SRP-LR, and the program will adequately manage the aging effects for which it is credited. The staff also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Therefore, on the basis of its review, the staff concludes that the applicant has demonstrated that the PS/PMP will effectively manage aging in the structures and components for which this program is credited so that the intended functions of the associated structures and systems will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.0.3.11 Structures Monitoring Program

The applicant described its SMP in Section B.2.10 of the LRA. The applicant credits this program with managing the aging of the containment, other Class 1 structures, and auxiliary system components that are within the scope of license renewal. The staff reviewed the SMP to determine whether the applicant has demonstrated that the program will adequately manage the applicable effects of aging during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.0.3.11.1 Summary of Technical Information in the Application

The LRA states that the SMP is consistent with GALL programs XI.S5, “Masonry Wall Program,” XI.S6, “Structures Monitoring Program,” and XI.S7, “RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants,” with the following two clarifications:

- FCS does not have the support components made from lubrite that are identified in The GALL Report, Chapter III, Item A4.2-b.
- FCS is not committed to RG 1.127.

In addition to the clarifications listed above, the following enhancements will be made to the SMP prior to the period of extended operation:

- Specific guidance will be added to inspect masonry walls for cracking and condition of steel bracing.
- Specific guidance will be added for inspection of component supports, new fuel storage racks, and the plant-specific components identified in LRA Table 3.5.
- Specific guidance will be added for the performance of periodic sampling and evaluation of ground water.
- Specific guidance will be added to inspect structural components when exposed by excavation.

The LRA also states that additional guidance will be added to the acceptance criteria and detection of aging effects to ensure that the SMP is consistent with industry codes, standards, and guidelines.

The applicant performed inspections in the auxiliary building, containment, intake structure, and turbine building in 1996-1997 and 1999-2000. No significant deterioration was identified, with the exception of some corrosion of support anchors, which was documented under the applicant’s CAP.

3.0.3.11.2 Staff Evaluation

LRA Section B.2.10 described the SMP, which is credited with managing the aging of several structural components. The LRA states that this AMP is consistent with GALL programs XI.S5, "Masonry Wall Program," XI.S6, "Structures Monitoring Program," and XI.S7, RG 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants," with two clarifications. The first clarification is that FCS does not have the support components made from lubrite that are identified in the GALL Report, Volume 2, Chapter III, Item A4.2-b. The second clarification is that FCS is not committed to RG 1.127. In addition, the staff also determined whether the applicant properly applied the SMP to its facility. Furthermore, the staff reviewed the applicant's claim that the SMP, with these clarifications and enhancements, is adequate to manage the aging effects for which it is credited.

With regard to the first clarification to GALL, the applicant states that FCS does not have the support components made from lubrite that are identified in GALL Chapter III, Item A4.2-b (reactor pressure vessel supports); however, FCS does have support components made of lubrite for other ASME components (e.g., SG supports), as identified in GALL Chapter III.B. The applicant stated that these components are inspected under the ISI program. The staff's evaluation of the ISI program is covered in Section 3.0.3.5 of this SER. For the second clarification, the applicant states that while FCS is not committed to RG 1.127, the applicable attributes from RG 1.127 have been incorporated into the SMP. The staff finds that the applicant's explanation and treatment of these two deviations to be adequate.

The applicant provided its USAR Supplement for the SMP in Section A.2.23 of the LRA. The staff reviewed the USAR Supplement and finds that the summary description contains a sufficient level of information to satisfy 10 CFR 54.21(d), and is acceptable.

3.0.3.11.3 Conclusion

On the basis of its review and inspection of the applicant's program, the staff finds that those portions of the program for which the applicant claims consistency with GALL are consistent with GALL. In addition, the staff has reviewed the clarifications and enhancements to the GALL program and finds that the applicant's program provides for adequate management of the aging effects for which the program is credited. The staff also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Therefore, on the basis of its review, including the applicant's commitments discussed above, the staff concludes that the applicant has demonstrated that the SMP will effectively manage aging in the structures and components for which this program is credited so that the intended functions of the associated components and systems will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.0.3.12 General Corrosion of External Surfaces Program

3.0.3.12.1 Summary of Technical Information in the Application

The applicant's general corrosion of external surfaces program is discussed in LRA Section B.3.3, "General Corrosion of External Surfaces Program."

This AMP is credited for the aging management of the effects of loss of material and cracking for applicable components, including piping, valves, supports, tanks, and bolting which are made of cadmium-plated steel, carbon steel, cast iron, copper alloy, galvanized steel, low-alloy steel, and neoprene. These components are exposed to an ambient air environment in the ESF, auxiliary, and steam and power conversion systems.

The activities credited in this program were selected based on their effectiveness as indicated by a review of site corrective action documents. In addition, the activities are elements of established FCS programs that have been ongoing for years and have been enhanced based on site and industry experience.

3.0.3.12.2 Staff Evaluation

In LRA Section B.3.3, “General Corrosion of External Surfaces Program,” the applicant described its AMP to manage the effects of loss of material and cracking for various components due to corrosion. This AMP is not consistent with a GALL AMP. Therefore, the staff reviewed this AMP against the 10 program elements defined in BTP RLSB-1, found in Appendix A of the SRP-LR. The staff also reviewed the USAR Supplement to determine whether it provides an adequate description of the program.

[Program Scope] As indicated in the LRA, the program consists of several FCS activities that manage the aging effects of loss of material and cracking for components in auxiliary boiler fuel oil, auxiliary building HVAC, auxiliary feedwater (AFW), chemical and volume control, CCW, containment ventilation, control room HVAC, diesel generator lube oil, starting air, feedwater, fire protection fuel oil, gaseous waste disposal, instrument air, main steam (MS) and turbine steam extraction, containment penetration systems and system interface components for non-CQE systems, nitrogen gas, primary sampling, raw water, and ventilating air. The staff finds that relevant systems and structures are included in the scope of the program, and therefore, the scope is acceptable.

[Preventive or Mitigative Actions] The applicant did not identify any preventive actions taken as part of this program. The staff recognizes that while this program may not prevent the occurrence of the aging effects stated, the program description should clearly describe the manner in which this program will be used to manage aging effects.

By letter dated October 11, 2002, the staff requested, in RAI B.3.3-1, that the applicant describe what this program accomplishes. In its response dated December 19, 2002, the applicant responded that this program is a condition monitoring program which identifies evidence of corrosion on external surfaces, or significant degradation of coatings, sealants, and caulking through visual inspections, and initiates corrective action prior to any loss of intended function. The staff notes that aging management of bolts is performed by several programs: bolting for mechanical systems is managed by this program and the bolting integrity program, structural bolting is managed by the structures monitoring program, and bolting degradation due to exposure to boric acid is identified by the boric acid corrosion prevention program

Based on the applicant’s response to the RAI, the staff concurs with the applicant that preventive actions are not needed because this is a condition monitoring program.

[Parameters Monitored or Inspected] The applicant stated that the surface conditions of components are monitored through visual observation and inspection to detect signs of external corrosion and to detect conditions that can result in external corrosion, such as fluid leakage.

By letter dated October 11, 2002, the staff requested, in RAI B.3.3-2, that the applicant describe the parameters, besides fluid leakage, that detect degradation of surface conditions on components within the scope of this program, and to justify why these parameters need not be included in this program to manage the aging of components within the program scope. In its response dated December 19, 2002, the applicant responded that fluid leakage was identified only as an example of a condition which could lead to component degradation if not corrected. Fluid leakage is an indicator of a degraded condition which, in addition, could lead to corrosion on surrounding components if allowed to continue. The applicant responded further by stating that this program includes monitoring of components and their external coatings for evidence of cracking, checking, blistering, rusting, pinholes, abrasions, delamination, and significant substrate defects (e.g., corrosion pits). The monitoring of these indications ensures that component degradation is identified and corrected prior to any loss of pressure boundary.

Based on the applicant's response to the RAI, the staff finds that the program monitors conditions that relate to the aging effects of concern.

[Detection of Aging Effects] The applicant indicated that the aging effects of loss of material and cracking are detected by visual observation and inspection of external surfaces. In addition, evidence for leaking fluids also provides indirect monitoring of certain components that are not routinely accessible.

By letter dated October 11, 2002, the staff requested, in RAI B.3.3-3, that the applicant describe the methods, besides the observance of fluid leakage, that will be used to detect loss of material and cracking in locations that may be inaccessible, such as the bottom of a tank, and provide a justification for why these methods are not material to demonstrate adequate aging management for components within the scope of the program. In its response dated December 12, 2002, the applicant stated that this program relies on visual observations and inspections, and is only applicable to those components accessible to this type of inspection. Aging management activities on components inaccessible to visual inspections, such as ultrasonic testing of buried emergency diesel fuel oil tank, are incorporated into other plant programs.

The staff finds the applicant's response to be reasonable and adequate because this program inspects for the aging effects of accessible components, in conjunction with other programs which inspect components not readily accessible.

[Monitoring and Trending] As described in Section B.3.3 of the LRA, various plant personnel perform periodic material condition inspections and observations outside containment. These inspections are performed in accordance with approved plant procedures and include documentation of the evidence of fluid leaks, significant coating damage, or significant corrosion. The inspections and observations are performed at intervals based on previous inspections and industry experience. For example, operator rounds occur several times a day and system engineer walk downs are performed at least quarterly. In addition, inspections inside containment are performed at each refueling outage and are part of the inspections described in the OPPD response to GL 98-04, "Potential 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."

By letter dated October 11, 2002, the staff requested, in RAI B.3.3-4, additional information on the extent of the documentation process, including whether inspections are documented and the results trended, or whether only significant findings are documented using a corrective action process. In its response dated December 12, 2002, the applicant responded that deficiencies identified during operator and system engineer walk downs are documented under the maintenance work order or corrective action process. Deficiencies identified during the containment coating inspection procedure would result in the initiation of a corrective action item if the deficiencies are significant as documented in this procedure. In addition, system engineers monitor and report ongoing and significant system deficiencies for their respective systems in their system report cards.

Based on the staff's review of the LRA, the applicant's response to the staff's RAI, and the findings of the AMR inspection, the staff finds that the activities associated with this program are appropriate because these activities and their frequency ensure that the aging effects of components within the scope of this program will be detected and corrected before compromising the components' intended functions.

[Acceptance Criteria] The applicant stated that plant procedures provide criteria for determining the acceptability of as-found conditions and for initiating the appropriate corrective action. These procedures incorporate appropriate provisions of NRC and industry guidance to avoid unacceptable degradation of the component intended functions by inspecting for the existence of leakage, presence of corrosion products, coating defects, and elastomer cracking.

By letter dated October 11, 2002, the staff requested, in RAI B.3.3-5, that the applicant discuss the NRC or industry guidance and operating experience used to establish the acceptance criteria. In its response dated December 19, 2002, the applicant responded that guidance from RG 1.54, "Service Level I, II, and III Protective Coatings Applied to Nuclear Power Plants," is incorporated in the containment coatings inspection discussed in Section 5.2.5 of the FCS USAR. In addition, the system engineer and operator walk downs initiate maintenance work orders or corrective action documents based on engineering judgement and operating experience. Initiation of a corrective action document is based on procedural guidance to identify damage or degradation that adversely affects the functional capability of a structure, system, or component. The applicant further responded that the procedural guidance is being enhanced as part of the implementation of this new program.

Based on the staff's review of the LRA, the applicant's response to the staff's RAI, and the findings in the AMR Inspection, the staff finds that the acceptance criteria and guidance associated with this program are appropriate because they incorporate adequate guidance to ensure that the aging effects of components within the scope of this program will be detected and corrected in a timely manner.

[Operating Experience] The applicant stated that the inspection activities of this program are a subset of a larger number of inspection activities and results in redundant inspections. The inspection activities credited in this program were selected based on their effectiveness, as indicated by a review of site corrective action documents. The applicant has completed a review of its records and concluded that the activities in this program are effective in detecting loss of material due to corrosion. These findings are consistent with the findings of recent internal and external assessments, such as audits and NRC inspections.

By letter dated October 11, 2002, the staff requested, in RAI B.3.3-6, that the applicant clarify whether this program will adequately manage the aging effects of inaccessible components within the scope of this program that are not routinely accessible and which rely on the indirect monitoring of fluid leakage. In its response dated December 19, 2002, the applicant responded that the scope of systems listed in Section B.3.3 excludes components that are not routinely accessible. Aging management of inaccessible components is incorporated into other plant programs. For example, ultrasonic testing of buried components and level monitoring and leakage detection are incorporated in the buried surfaces external corrosion program and the diesel fuel monitoring and storage program. Inspections and monitoring of these components has not identified any degradation.

During the staff's AMR inspection, the applicant committed to revise the general corrosion of external surfaces program to include the spent fuel pool cooling system. This was identified as ~~is~~ Confirmatory Item 3.0.3.12.2-1.

By letter dated July 7, 2003, the applicant made the revision, noting that the spent fuel pool heat exchanger is the only system component within scope that is fabricated from carbon steel. All other system components are fabricated from stainless steel. Therefore, the heat exchanger shell requires external surface aging management for loss of material.

On the basis of the applicant's revision to the general corrosion of external surfaces program, the staff concludes that the AMP will provide adequate aging management for the components of the spent fuel pool cooling system. Confirmatory Item 3.0.2.12.2-1 is closed.

Based on the staff's review of the LRA, the applicant's response to the staff's RAI, and the findings in the staff's AMR inspection and audit conducted from January 6-10, 2003, and from January 20-23, 2003, the staff finds that the activities in this program have effectively managed the aging effects of components within the scope of this program and will continue to do so in the period of extended operation.

The applicant provided its USAR Supplement for the general corrosion of external surfaces program in Section A.2.13 of the LRA. The staff reviewed the USAR Supplement and finds that the summary description contains a sufficient level of information, as required by 10 CFR 54.21(d), and is acceptable.

3.0.3.12.3 Conclusions

On the basis of its review and inspection of the applicant's program, the staff finds that the program adequately addresses the ten program elements defined in BTP RLSB-1, found in Appendix A.1 of the SRP-LR, and that the program will adequately manage the aging effects for which it is credited. The staff also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Therefore, on the basis of its review, the staff concludes that the applicant has demonstrated that the general corrosion of external surfaces program will effectively manage aging in the

structures and components for which this program is credited so that the intended functions of the associated components and systems will be maintained consistent with the CLB for the period of extended operation, as required by
10 CFR 54.21(a)(3).

3.0.3.13 One-Time Inspection Program

3.0.3.13.1 Summary of Technical Information in the Application

The applicant's one-time inspection program is discussed in LRA Section B.3.5, "One Time Inspection Program." The applicant states that the program is consistent with GALL program XI.M32, "One-Time Inspections," as identified in the GALL Report.

This AMP is credited with managing the aging effects of components in the reactor, ESF, auxiliary, and steam and power conversion systems.

3.0.3.13.2 Staff Evaluation

In LRA Section B.3.5, "One Time Inspection Program," the applicant described its AMP to manage aging in reactor, ESF, auxiliary, and steam and power conversion systems. The LRA stated that this AMP is consistent with GALL AMP XI.M32, "One-Time Inspections," with no deviations. For this AMP, GALL recommends that the program be reviewed by the staff on a plant-specific basis. The staff confirmed the applicant's claim of consistency during the AMR inspection. The staff also reviewed the USAR Supplement to determine whether it provides an adequate description of the program.

The program description in GALL AMP XI.M32 indicates that the one-time inspection program is to provide additional assurance that either aging is not occurring or evidence that aging is so insignificant that an AMP is not warranted. As an example, the description indicates that for Class 1 piping with a diameter less than nominal pipe size (NPS) 4 inch that does not receive volumetric examination during inservice inspection, the one-time inspection program confirms that crack initiation and growth due to SCC or cyclic loading is not occurring and, therefore, there is no need to manage age-related degradation for the period of extended operation. The "Detection of Aging Effects" portion of GALL AMP XI.M32 indicates that for small-bore piping less than NPS 4 inches, including pipe, fittings, and branch connections, a plant-specific destructive examination of replaced piping due to plant modification, or non destructive examination (NDE) that permits inspection of the inside surfaces of the piping, is to be conducted to ensure cracking has not occurred. Inspection of the inside surface can be performed using volumetric examination.

During its inspection and audit conducted from January 6-10, 2003, and from January 20-23, 2003, the staff reviewed FCS documents to confirm that FCS was implementing the one-time inspection program for small-bore piping in the RCS, in accordance with GALL AMP XI.M.32. Specifically, Attachment 3 to the FCS engineering analysis (EA-FC-00-088) provides a program description and a direct comparison of the ten elements in GALL AMP XI.M32 and the FCS activity to implement the one-time inspection program. The applicant has committed to develop this program prior to entering the license renewal term.

The basis for this program will be documented in the FCS one-time inspection program basis document. EA-FC-00-88 indicates that the one-time inspection program will include RCS small-bore piping that is susceptible to crack initiation and growth due to SCC or cyclic loading. Although the FCS EA specifies the criteria in GALL AMP XI.M32, cyclic loading is a general requirement. In order to designate locations that are most susceptible to failure from cyclic loading, the mechanism which could cause age-related degradation must be specified.

The staff was concerned that cyclic loading that is caused by thermal fatigue resulting from thermal stratification or turbulent penetration could lead to the loss of function in small-bore piping. The staff reviewed Attachment 6 to EA-FC-00-88, which identifies all components that are to be included in the one-time inspection program. This document indicates that reactor coolant stainless steel small-bore piping components in borated treated water will receive augmented inspection using volumetric examination or equivalent. This document did not address carbon steel small-bore piping in the RCS. By letter dated February 20, 2003, the staff issued POI-8(e) requesting that the applicant clarify whether the one-time inspection program will include RCS small-bore piping that is susceptible to crack initiation and growth due to SCC or thermal fatigue resulting from thermal stratification or turbulent penetration, and whether there is carbon steel small-bore piping with full penetration welds in the RCS system. If there is carbon steel small-bore piping with full penetration welds in the RCS, the applicant should include this piping in its one-time inspection program. By letter dated March 14, 2003, the applicant responded to POI-8(e), stating that since FCS is a pressurized-water reactor (PWR) with stainless steel loops, there is no carbon steel small-bore piping in the RCS. It is a borated water system, therefore, the use of carbon steel would be inappropriate.

In response to this POI, the applicant committed to the requirements in GALL Section XI.M32, relative to the inspection of small-bore RCS piping and to base inspections on those locations where small-bore piping is subject to thermal cycling stratification or turbulent penetration. On the basis of this commitment, and that there is no carbon steel small-bore piping in the RCS, POI-8(e) is resolved.

The applicant provided its USAR Supplement for the one-time inspection program in Section A.2.12 of the LRA. The staff reviewed the USAR Supplement and finds that the summary description contains a sufficient level of information to satisfy 10 CFR 54.21(d), and is acceptable. The staff notes that the one-time inspection is intended to confirm that aging is not occurring or that the aging is so insignificant that an AMP is not warranted. The applicant proposes to use this AMP across a wide range of structures and components at FCS. The staff has identified the commitments associated with this AMP in Appendix A of this SER.

3.0.3.13.3 Conclusions

On the basis of its review, and inspection and audit of the applicant's program, the staff finds that those portions of the program for which the applicant claims consistency with GALL are consistent with GALL. The staff also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d). The staff notes that the one-time inspection is intended to confirm that aging is not occurring or that the aging is so insignificant that an AMP is not warranted. The applicant proposes to use this AMP across a wide range of structures and component at FCS. The staff has identified the applications of this AMP in Appendix A of this SER.

Therefore, on the basis of its review, including the applicant's commitments discussed above, the staff concludes that the applicant has demonstrated that the one-time inspection program will effectively manage aging in the structures and components for which this program is credited so that the intended functions of the associated SSCs will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.0.3.14 Selective Leaching Program

3.0.3.14.1 Summary of Technical Information in the Application

The applicant's selective leaching program is discussed in LRA Section B.3.6, "Selective Leaching Program." The applicant states that the program is consistent with the GALL program XI.M33, "Selective Leaching of Materials," with the exception that the applicant will not perform an evaluation of selective leaching by means of hardness testing during the one-time inspection.

The AMP is credited with managing aging effects in the systems containing plant-specific components susceptible to the selective leaching mechanism. The aging effects are managed in the components which either are not evaluated in GALL, or, although not specifically evaluated, are relying on the AMP in GALL. These components are listed in Tables 3.2-2, 3.3-2, 3.3-3, 3.4-2, and 3.5-3 of the LRA and are included in ESF, auxiliary, and steam and power conversion systems, and containment structures and components. These components are made from cast iron, copper alloy, copper-zinc alloys, brass, ductile iron, and bronze. Selective leaching takes place when these components are exposed to raw water, corrosion-inhibited treated water, oxygenated and deoxygenated treated water, or are buried underground. The applicant's selective leaching program relies on inspection of the affected components.

3.0.3.14.2 Staff Evaluation

In LRA Section B.3.6, "Selective Leaching Program," the applicant described its AMP to manage aging effects due to selective leaching. The LRA stated that this AMP is consistent with GALL AMP XI.M33, with the clarification that the applicant will not perform an evaluation of selective leaching by means of hardness testing during the one-time inspection. The staff confirmed the applicant's claim of consistency during the AMR inspection. Furthermore, the staff reviewed the clarification and its justification to determine whether the AMP, with the clarification, remains adequate to manage the aging effects for which it is credited, and reviewed the USAR Supplement to determine whether it provides an adequate description of the revised program.

The clarification of the program causes changes in some attributes of the GALL selective leaching program. Therefore, the staff reviewed this AMP against only those attributes of the applicant's program which deviate from the attributes of the GALL's selective leaching of materials program using the guidance in BTP RLSB-1, found in Appendix A of the SRP-LR.

[Scope of Program] The scope of the applicant's selective leaching program and the scope of the corresponding program in GALL do not address selective leaching in the buried copper-zinc pipes. However, in response to the staff's RAI B.3.6-2, issued by letter dated October 11, 2002, the applicant, by letter dated December 19, 2002, indicated that the selective leaching program will credit the inspections performed by the “Buried Surfaces External Corrosion Program” in Section B.3.2 of the LRA. The staff finds this acceptable because the buried surfaces external corrosion program scope includes the copper-zinc pipes. The staff’s evaluation of the buried surfaces external corrosion program can be found in Section 3.3.2.3.2 of this SER.

[Parameters Monitored or Inspected] The applicant’s selective leaching program deviates from the program in GALL by not requiring evaluation of selective leaching by means of hardness testing with a one-time inspection. By letter dated October 11, 2002, the staff issued RAI B.3.6-1, requesting the applicant to describe how the degradation due to leaching can be evaluated without hardness measurements, particularly for cases in which visual inspection cannot produce meaningful results. By letter dated December 19, 2002, the applicant justified this deviation by pointing out that there is no suitable equipment for performing these tests in the field. The staff finds this acceptable because the applicant is not able to perform this evaluation with its equipment.

The applicant provided its USAR Supplement for the selective leaching program in Section A.2.21 of the LRA. The staff reviewed the USAR Supplement and finds that the summary description contains a sufficient level of information to satisfy 10 CFR 54.21(d), and is acceptable.

3.0.3.14.3 Conclusions

On the basis of its review and inspection of the applicant’s program, the staff finds that those portions of the program for which the applicant claims consistency with GALL are consistent with GALL. In addition, the staff has reviewed the clarification to the GALL program and finds that the applicant’s program provides for adequate management of the aging effects for which the program is credited. The staff also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Therefore, on the basis of its review, the staff concludes that the applicant has demonstrated that the selective leaching program will effectively manage aging in the structures and components for which this program is credited so that the intended functions of the associated components and systems will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.0.3.15 Evaluation Findings

The staff has reviewed the common AMPs in Appendix B of the LRA. On the basis of its review, including the applicant’s commitments discussed above, the staff concludes that the applicant has demonstrated that these AMPs will effectively manage aging in the structures and components for which these AMPs are credited so that these components will perform their intended functions in accordance with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3). In addition, the staff has reviewed the the USAR Supplements for these AMPs and concludes that the USAR Supplements provide an acceptable description of the programs and activities for managing the effects of aging of the components for which the AMPs are credited, as required by 10 CFR 54.21(d).

3.0.4 FCS Quality Assurance Program Attributes Integral to Aging Management Programs

The staff has reviewed LRA Appendix B, Section 2.0, "Aging Management Activities," in accordance with the requirements of 10 CFR 54.21(a)(3) and 10 CFR 54.21(d). The staff has evaluated the adequacy of certain aspects of the applicant's programs to manage the effects of aging. The particular aspects reviewed by the staff in this section encompass three quality assurance program attributes, namely corrective actions, confirmation process, and administrative controls. These three attributes of the quality assurance program are addressed for all of the applicant's AMPs.

An applicant for license renewal is required to demonstrate that the effects of aging on structures and components that are subject to an AMR will be adequately managed to ensure that their intended functions will be maintained in a manner that is consistent with the CLB of the facility throughout the period of extended operation. To manage these effects, applicants have developed new, or revised existing, AMPs and applied those programs to the SSCs of interest. For each of these AMPs, the existing 10 CFR Part 50, Appendix B, quality assurance program may be used to address the attributes of corrective actions, confirmation process, and administrative controls.

3.0.4.1 Summary of Technical Information in Application

Chapter 3.0, "Aging Management Review Results," of the LRA provides an AMR summary for each unique structure, component, or commodity group at FCS determined to require aging management during the period of extended operation. This summary includes identification of the aging effects requiring management (AERMs) and AMPs utilized to manage these aging effects.

Appendix B, Section 2.0, "Aging Management Activities," of the LRA provides the aging management activity description for each activity credited for managing aging effects. These activities are based upon the AMR results provided in Sections 3.1 through 3.6 of the LRA. The applicant stated that it uses the existing FCS quality assurance program, consistent with the summary table in Appendix A.2 of NUREG-1800, "Standard Review Plan for the Review of License Renewal Applications for Nuclear Power Plants," published July 2001 (SRP-LR) to address the elements of corrective action, confirmation process, and administrative controls for all of its AMPs. The FCS quality assurance program implements the requirements of 10 CFR Part 50, Appendix B. The applicant further states that these programs, credited for license renewal, encompass both the safety-related and non-safety-related SSCs within the scope of license renewal.

AMPs identified in Appendix B, Section 2.0 of the LRA, as new or enhanced programs, provide descriptions of the specific attributes of corrective action, confirmation process, and administrative controls. These programs include B.2.7, "Periodic Surveillance and Preventive Maintenance (PM) Program," and B.3.3, "General Corrosion of External Surfaces Program."

With respect to the three quality assurance attributes, the applicant's program descriptions describe these as follows.

1. Corrective Action-Identified deviations are evaluated within the FCS corrective action process which includes provisions for root cause determinations and corrective actions

to prevent recurrence as dictated by the significance of the deviation. The FCS corrective action process is in accordance with 10 CFR Part 50, Appendix B.

2. Confirmation Process-The FCS corrective action process is in accordance with the 10 CFR Part 50, Appendix B and includes reviews to assure that proposed actions, tracking and reporting of open corrective actions, root cause determinations, and reviews of corrective action effectiveness are adequate.

3. Administrative Controls-All credited aging management activities are subject to the FCS administrative controls process, which is in accordance with 10 CFR Part 50, Appendix B, and requires formal reviews and approvals.

3.0.4.2 Staff Evaluation

The staff has evaluated the adequacy of certain aspects of the applicant's programs to manage the effects of aging. The particular aspects reviewed by the staff in this section encompass three quality assurance program attributes, namely corrective actions, confirmation process, and administrative controls. These three attributes of the quality assurance program are used in all of the applicant's AMPs.

During the audit of the FCS scoping and screening methodology conducted July 8-12, 2002, the staff reviewed the applicant's programs described in Appendix A, "Updated USAR Supplement," and Appendix B, "Aging Management Activities," to assure that the aging management activities were consistent with the staff's guidance described in Section A.2, "Quality Assurance for Aging Management Programs" and BTP IQMB-1, regarding quality assurance of the SRP-LR. During the review, the applicant stated that the attributes of corrective action, confirmation process, and administrative control were developed for, and are integral to, the site quality assurance programs. The audit team confirmed that the applicant credited this process for both the safety-related and non-safety-related structures, systems, and components (SSCs) within the scope of license renewal.

Based on the staff's evaluation, the description and applicability of the AMPs and their associated attributes to all safety-related and non-safety-related structures and components (SCs) provided in Appendix A and Appendix B of the LRA are consistent with the staff's position regarding quality assurance for aging management. However, the staff noted that the applicant had not sufficiently described the use of the quality assurance program and its associated attributes (corrective action, confirmation process, and administrative control) in the application. In a letter dated October 11, 2002, the staff requested that the applicant clarify its description in Appendix A and Appendix B of the LRA to include aspects of the quality assurance program that are credited for the three AMP attributes identified above (RAI 2.1-2).

In a letter dated December 19, 2002, the applicant provided a response to the staff's RAI. In that response, the applicant described how the quality assurance program referenced in Appendix A and Appendix B of the LRA is used and described the associated attributes of corrective action, confirmation process, and administrative control relative to the AMPs. Specifically, the applicant stated that the FCS quality assurance plan implements the requirements of 10 CFR Part 50, Appendix B, and is consistent with the summary in Section A.2 of the SRP-LR. The FCS quality assurance plan includes the elements of corrective action, confirmation process, and administrative controls and is applicable to the safety-related and non-safety-related structures, systems, and components that are within the scope of license renewal.

The applicant further stated that corrective action is initiated upon identification of conditions adverse to quality through the FCS condition report system. This includes review for significance, cause determination, corrective actions, prevention of recurrence, and trending. The FCS quality assurance plan provides for control over activities affecting the quality of SSCs consistent with their importance to safety. Confirmation is achieved through review by the FCS plant review committee of proposed corrective actions for significant conditions adverse to quality. Activities affecting safety are described by written procedures of a type appropriate to the circumstances, and are accomplished in accordance with these instructions and procedures. These procedures include appropriate quantitative or qualitative acceptance criteria for determining that important activities have been satisfactorily accomplished.

Based on the information provided in the LRA, as supplemented by the applicant's response to the staff's RAI, the staff has determined that for all AMPs credited for license renewal, the corrective actions, confirmation process, and administrative controls are adequately addressed in the applicant's approved quality assurance program and satisfy the requirements of 10 CFR 54.21(a)(3). Therefore, RAI 2.1-2 is resolved.

With regard to the summary descriptions of the corrective actions, confirmation process, and administrative controls program attributes, the staff finds that the applicant has provided an acceptable summary description of these generic program attributes in the USAR Supplement, as required by 10 CFR 54.21(d).

3.0.4.3 Conclusion

The staff finds that the applicant's response to the staff's RAI provides a sufficient description of the quality assurance program attributes and activities for managing the effects of aging. The staff finds that the quality assurance attributes satisfy 10 CFR 54.21(a)(3). With regard to the USAR Supplement, the applicant has provided an acceptable USAR Supplement describing the three program elements of corrective actions, confirmation process, and administrative controls. On this basis, the staff concludes that the applicant has provided an adequate description of the program attributes to satisfy 10 CFR 54.21(d).

3.1 Reactor Systems

This section addresses the aging management of the components of the reactor systems group. The systems that make up the reactor systems group are described in the following SER sections:

- Reactor Vessel Internals (2.3.1.1)
- Reactor Coolant System (2.3.1.2)
- Reactor Vessel (2.3.1.3)

As discussed in Section 3.0.1 of this SER, the components in each of these reactor systems are included in one of three LRA tables. LRA Table 3.1-1 consists of reactor system components that are evaluated in the GALL Report, LRA Table 3.1-2 consists of reactor system components that are not evaluated in the GALL Report, and LRA Table 3.1-3 consists of reactor system components that were not evaluated in the GALL Report, but the applicant has determined can be managed using a GALL AMR and associated AMP.

3.1.1 Summary of Technical Information in the Application

In LRA Section 3.1, the applicant described its AMRs for the reactor systems group at FCS.

The passive, long-lived components in these systems that are subject to an AMR are identified in LRA Tables 2.3.1.1-1, 2.3.1.2-1, and 2.3.1.3-1.

The applicant's AMRs include an evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. These reviews concluded that the aging effects requiring management based on FCS operating experience were consistent with aging effects identified in GALL.

The applicant's review of industry operating experience included a review of operating experience through 2001. The results of this review concluded that AERMs based on industry operating experience were consistent with aging effects identified in GALL.

The applicant's ongoing review of plant-specific and industry operating experience is conducted in accordance with the FCS operating experience program.

3.1.2 Staff Evaluation

In Section 3.1 of the LRA, the applicant describes its AMR for the reactor systems at FCS. The staff reviewed LRA Section 3.1 to determine whether the applicant has provided sufficient information to demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB throughout the period of extended operation, in accordance with the requirements of 10 CFR 54.21(a)(3), for the reactor system components that are determined to be within the scope of license renewal and subject to an AMR.

The applicant referenced the GALL Report in its AMR. The staff has previously evaluated the adequacy of the aging management of reactor system components for license renewal as documented in the GALL Report. Thus, the staff did not repeat its review of the matters described in the GALL Report, except to ensure that the material presented in the LRA was applicable, and to verify that the applicant had identified the appropriate programs as described and evaluated in the GALL Report. The staff evaluated those aging management issues recommended for further evaluation in the GALL Report. The staff also reviewed aging management information submitted by the applicant that was different from that in the GALL Report or was not addressed in the GALL Report. Finally, the staff reviewed the USAR Supplement to ensure that it provided an adequate description of the programs credited with managing aging for the reactor system components.

Table 3.1-1 below provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.1 that are addressed in the GALL Report.

Table 3.1-1

Staff Evaluation Table for FCS Reactor System Components in the GALL Report

Component Group	Aging Effect/Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Reactor coolant pressure boundary components	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	TLAA	Consistent with GALL. GALL recommends further evaluation (See Section 3.1.2.2.1 below)
Steam generator shell assembly	Loss of material due to pitting and crevice corrosion	Inservice inspection; water chemistry	Inservice Inspection (B.1.6), Chemistry (B.1.2), and Steam Generator (B.2.9) Programs	Consistent with GALL. GALL recommends further evaluation (See Section 3.1.2.2.2 below)
BWR isolation condenser	Loss of material due to general, pitting and crevice corrosion	Inservice inspection; water chemistry	Not applicable since FCS is a PWR	Not applicable since FCS is a PWR
Pressure vessel ferritic materials that have a neutron fluence greater than 10^{17} n/cm^2 (E>1 MeV)	Loss of fracture toughness due to neutron irradiation embrittlement	TLAA, evaluated in accordance with Appendix G of 10 CFR 50 and RG 1.99	TLAA	Consistent with GALL. GALL recommends further evaluation (See Section 3.1.2.2.3 below)
Reactor vessel beltline shell and welds	Loss of fracture toughness due to neutron irradiation embrittlement	Reactor vessel surveillance	Reactor Vessel Integrity Program (B.1.7)	Consistent with GALL. GALL recommends further evaluation (See Section 3.1.2.2.3 below)
Westinghouse and B&W baffle/former bolts	Loss of fracture toughness due to neutron irradiation embrittlement and void swelling	Plant-specific	Not applicable since FCS is a CE plant	Not applicable since FCS is a CE plant
Small-bore reactor coolant system and connected systems piping	Crack initiation and growth due to SCC, intergranular SCC, and thermal and mechanical loading	Inservice inspection; water chemistry; one-time inspection	Inservice Inspection (B.1.6), Chemistry (B.1.2), and One-Time Inspection (B.3.5) Programs	Consistent with GALL. GALL recommends further evaluation (See Section 3.1.2.2.4 below)
Jet pump sensing line, and reactor vessel flange leak detection line	Crack initiation and growth due to SCC, intergranular stress corrosion cracking (IGSCC), or cyclic loading	Plant-specific	Inservice Inspection (B.1.6), Chemistry (B.1.2), and One-Time Inspection (B.3.5) Programs	GALL recommends further evaluation of the reactor vessel flange leak detection line (See Section 3.1.2.2.4 below)
BWR - Isolation condenser	Crack initiation and growth due to stress corrosion cracking (SCC) or cyclic loading;	Inservice inspection; water chemistry	Not applicable since FCS is a PWR	Not applicable since FCS is a PWR
Vessel shell	Crack growth due to cyclic loading	TLAA	TLAA	Consistent with GALL. GALL recommends further evaluation (See Section 3.1.2.2.5 below)

Reactor internals	Changes in dimension due to void swelling	Plant-specific	Reactor Vessel Internals Inspection Program (B.2.8)	Consistent with GALL. GALL recommends further evaluation (See Section 3.1.2.2.6 below)
PWR core support pads, instrument tubes (bottom head penetrations), pressurizer spray heads and nozzles for the steam generator instruments and drains	Crack initiation and growth due to SCC and/or primary water stress corrosion cracking (PWSCC)	Plant-specific	Alloy 600 Program (B.3.1)	Consistent with GALL. GALL recommends further evaluation (See Section 3.1.2.2.7 below)
Cast austenitic stainless steel (CASS) reactor coolant system piping	Crack initiation and growth due to SCC	Plant-specific	Chemistry (B.1.2), Inservice Inspection (B.1.6), and Thermal Embrittlement of Cast Austenitic Stainless Steel (B.3.7) Programs	Consistent with GALL. GALL recommends further evaluation (See Section 3.1.2.2.7 below)
Pressurizer instrumentation penetrations and heater sheaths and sleeves made of Ni-alloys	Crack initiation and growth due to PWSCC	Inservice inspection; water chemistry	Alloy 600 (B.3.1), Chemistry (B.1.2), and Inservice Inspection (B.1.6) Programs	Consistent with GALL. GALL recommends further evaluation (See Section 3.1.2.2.7 below)
Westinghouse and B&W baffle former bolts	Crack initiation and growth due to SCC and IASCC	Plant-specific	Not applicable since FCS is a CE plant	Not applicable since FCS is a CE plant (See Section 3.1.2.2.8 below)
Westinghouse and B&W baffle former bolts	Loss of preload due to stress relaxation	Plant-specific	Not applicable since FCS is a CE plant	Not applicable since FCS is a CE plant (See Section 3.1.2.2.9 below)
Steam generator feedwater impingement plate and support	Loss of section thickness due to erosion	Plant-specific	Not applicable to FCS	Not applicable to FCS (See Section 3.1.2.2.10 below)
(Alloy 600) Steam generator tubes, repair sleeves, and plugs	Crack initiation and growth due to PWSCC, outside diameter stress corrosion cracking (ODSCC), and/or intergranular attack (IGA) or loss of material due to wastage and pitting corrosion, and fretting and wear; or deformation due to corrosion at tube support plate intersections	Steam generator tubing integrity; water chemistry	Steam Generator (B.2.9), and Chemistry (B.1.2), Programs	Consistent with GALL. GALL recommends further evaluation (See Section 3.1.2.2.11 below)
Tube support lattice bars made of carbon steel	Loss of section thickness due to FAC	Plant-specific	Steam Generator Program (B.2.9)	Consistent with GALL. GALL recommends further evaluation (See Section 3.1.2.2.12 below)

Carbon steel tube support plate	Ligament cracking due to corrosion	Plant-specific	Steam Generator (B.2.9), and Chemistry (B.1.2), Programs	Consistent with GALL. GALL recommends further evaluation (See Section 3.1.2.2.13 below)
Steam generator feedwater inlet ring and supports	Loss of material due to flow-accelerated corrosion	Combustion Engineering (CE) steam generator feedwater ring inspection	Since this aging effect is applicable to System 80 plants, It is not applicable to FCS	Since this aging effect is applicable to System 80 plants, It is not applicable to FCS (See Section 3.1.2.2.14 below)
Reactor vessel closure studs and stud assembly	Crack initiation and growth due to SCC and/or IGSCC	Reactor head closure studs	The reactor head closure stud program is incorporated into the Bolting Integrity Program (B.1.1)	Consistent with GALL (See Section 3.1.2.1 below)
CASS pump casing and valve body	Loss of fracture toughness due to thermal aging embrittlement	Inservice inspection	Inservice Inspection Program (B.1.6)	Consistent with GALL (See Section 3.1.2.1 below)
CASS piping	Loss of fracture toughness due to thermal aging embrittlement	Thermal aging embrittlement of CASS	Thermal Aging Embrittlement of Cast Austenitic Stainless Steel Program (B.3.7)	Consistent with GALL (See Section 3.1.2.1 below)
BWR/PWR piping and fittings; steam generator components	Wall thinning due to flow-accelerated corrosion	Flow-accelerated corrosion	Flow Accelerated Corrosion Program (B.1.5)	Consistent with GALL (See Section 3.1.2.1 below)
Reactor coolant pressure boundary (RCPB) valve closure bolting, manway and holding bolting, and closure bolting in high pressure and high temperature systems	Loss of material due to wear; loss of preload due to stress relaxation; crack initiation and growth due to cyclic loading and/or SCC	Bolting integrity	Bolting Integrity Program (B1.1)	Consistent with GALL (See Section 3.1.2.1 below)
BWR - Feedwater and control rod drive (CRD) return line nozzles	Crack initiation and growth due to cyclic loading	Feedwater nozzle; CRD return line nozzle	Not applicable since FCS is a PWR	Not applicable since FCS is a PWR
BWR - Vessel shell attachment welds	Crack initiation and growth due to SCC, IGSCC	BWR vessel ID attachment welds; water chemistry	Not applicable since FCS is a PWR	Not applicable since FCS is a PWR
BWR - Nozzle safe ends, recirculation pump casing, connected systems piping and fittings, body and bonnet of valves	Crack initiation and growth due to SCC, IGSCC	BWR stress corrosion cracking; water chemistry	Not applicable since FCS is a PWR	Not applicable since FCS is a PWR
BWR - Penetrations	Crack initiation and growth due to SCC, IGSCC, cyclic loading	BWR penetrations; water chemistry	Not applicable since FCS is a PWR	Not applicable since FCS is a PWR

BWR - Core shroud and core plate, support structure, top guide, core spray lines and spargers, jet pump assemblies, control rod drive housing, nuclear instrumentation guide tubes	Crack initiation and growth due to SCC, IGSCC, IASCC	BWR vessel internals; water chemistry	Not applicable since FCS is a PWR	Not applicable since FCS is a PWR
BWR - Core shroud and core plate access hole cover (welded and mechanical covers)	Crack initiation and growth due to SCC, IGSCC, IASCC	ASME Section XI inservice inspection; water chemistry	Not applicable since FCS is a PWR	Not applicable since FCS is a PWR
BWR - Jet pump assembly castings; orificed fuel support	Loss of fracture toughness due to thermal aging and neutron embrittlement	Thermal aging and neutron irradiation embrittlement	Not applicable since FCS is a PWR	Not applicable since FCS is a PWR
BWR - Unclad top head and nozzles	Loss of material due to general, pitting, and crevice corrosion	Inservice inspection; water chemistry	Not applicable since FCS is a PWR	Not applicable since FCS is a PWR
CRD nozzle	Crack initiation and growth due to PWSCC	Ni-alloy nozzles and penetrations; water chemistry	Chemistry (B.1.2) and Alloy 600 (B.3.1) Programs	Consistent with GALL (See Section 3.1.2.1 below)
Reactor vessel nozzles safe ends and CRD housing; reactor coolant system components (except CASS and bolting)	Crack initiation and growth due to cyclic loading, and/or SCC and PWSCC	Inservice inspection; water chemistry	Inservice Inspection (B.1.6) and Chemistry (B.1.2) Programs	Consistent with GALL (See Section 3.1.2.1.1 for CRD housings and Section 3.1.2.1 below)
Reactor vessel internals CASS components	Loss of fracture toughness due to thermal aging, neutron irradiation embrittlement, and void swelling	Thermal aging and neutron irradiation embrittlement	Reactor Vessel Internals Inspection Program (B.2.8)	Consistent with GALL (See Section 3.1.2.1 below)
External surfaces of carbon steel components in reactor coolant system pressure boundary	Loss of material due to boric acid corrosion	Boric acid corrosion	Boric Acid Corrosion Prevention Program (B.2.1)	Consistent with GALL (See Section 3.1.2.1 below)
Steam generator secondary manways and handholds (CS)	Loss of material due to erosion	Inservice inspection	Not applicable to FCS	Not applicable to FCS because GALL indicates this item is applicable to B&W steam generators
Reactor internals, reactor vessel closure studs, and core support pads	Loss of material due to wear	Inservice Inspection	Inservice Inspection Program (B.1.6)	Consistent with GALL (See Section 3.1.2.1 below)

Pressurizer integral support	Crack initiation and growth due to cyclic loading	Inservice Inspection	Not applicable to FCS	Not applicable to FCS (See Section 3.1.2.1.2 below)
Upper and lower internal assembly (Westinghouse)	Loss of preload due to stress relaxation	Inservice Inspection; loose part and/or neutron noise monitoring	Not applicable since FCS is a CE plant	Not applicable since FCS is a CE plant
Reactor vessel internals in fuel zone region (except Westinghouse and Babcock & Wilcox [B&W] baffle bolts)	Loss of fracture toughness due to neutron irradiation embrittlement, and void swelling	PWR vessel internals; water chemistry	Chemistry (B.1.2) and Reactor Vessel Internals Inspection (B.2.8)	Consistent with GALL (See Section 3.1.2.1 below)
Steam generator upper and lower heads; tubesheets; primary nozzles and safe ends	Crack initiation and growth due to SCC, PWSCC, IASCC	Inservice inspection; water chemistry	Inservice Inspection (B.1.6) and Chemistry (B.1.2) Programs	Consistent with GALL (See Section 3.1.2.1 below)
Vessel internals (except Westinghouse and B&W baffle former bolts)	Crack initiation and growth due to SCC and IASCC	PWR vessel internals; water chemistry	Chemistry (B.1.2) and Reactor Vessel Internals Inspection (B.2.8)	Consistent with GALL (See Section 3.1.2.1 below)
Reactor internals (B&W screws and bolts)	Loss of preload due to stress relaxation	Inservice inspection; loose part monitoring	Not applicable since FCS is a CE plant	Not applicable since FCS is a CE plant
Reactor vessel closure studs and stud assembly	Loss of material due to wear	Reactor head closure studs	The reactor head closure stud program is incorporated into the Bolting Integrity Program (B.1.1)	Consistent with GALL (See Section 3.1.2.1 below)
Reactor internals (Westinghouse upper and lower internal assemblies; CE bolts and tie rods)	Loss of preload due to stress relaxation	Inservice inspection; loose part monitoring	Inservice Inspection Program (B.1.6)	Since it does not credit loose part monitoring, it is not consistent with GALL (See Section 3.1.2.1.3 below)

The staff's review of the reactor systems group for the FCS LRA is contained within four sections of this SER. Section 3.1.2.1 is the staff review of components in the reactor systems that the applicant indicates are consistent with GALL and do not require further evaluation. Section 3.1.2.2 is the staff review of components in the reactor systems that the applicant indicates are consistent with GALL and GALL recommends further evaluation. Section 3.1.2.3 is the staff evaluation of aging management programs that are specific to the reactor systems. Section 3.1.2.4 contains an evaluation of the adequacy of aging management for components in each system in the reactor systems group and includes an evaluation of components in the reactor systems that the applicant indicates are not in GALL. This section is divided into three subsections, reactor vessel internals, reactor coolant system, and reactor vessel. These are the three systems that the applicant has identified as within the reactor systems group.

3.1.2.1 Aging Management Evaluations in the GALL Report That Are Relied on for License Renewal, Which Do Not Require Further Evaluation

For component groups evaluated in GALL for which the applicant has claimed consistency with GALL, and for which GALL does not recommend further evaluation, the staff sampled components in these groups during the AMR inspection to determine whether the plant-specific components contained in these GALL component groups were bounded by the GALL evaluation. The staff also sampled component groups during the AMR inspection to determine whether the applicant had properly identified those component groups in GALL that were not applicable to its plant. The results of the staff's AMR inspection can be found in Inspection Report 50-285/03-07, dated March 20, 2003.

On the basis of its review of the inspection results, the staff finds that the applicant's claim of consistency with GALL is acceptable, and that it is acceptable for the applicant to reference the information in the GALL Report for reactor system components. Therefore, on this basis, the staff concludes that the applicant has demonstrated that the components for which the applicant claimed consistency with GALL will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.1.1 Cracking of Control Rod Drive Housings

Programs identified in the GALL Report are generic programs. When components experience unusual aging effects, the programs identified in the GALL Report may not be applicable. Control rod drive (CRD) housings (LRA Table 3.1-1, row 3.1.1.25), which are fabricated from stainless steel, are identified as being susceptible to SCC and primary water stress corrosion cracking (PWSCC) with aging management provided by the ISI (B.1.6) and chemistry (B.1.2) programs. Cracking has been reported on CRD housings at FCS (January 25, 2002, letter from OPPD) and Palisades (Nuclear Management Company letters to the NRC dated August 20, 2001, and March 14, 2002). The Palisades and FCS CRD housings have similar designs.

Because this operating experience was not considered in the development of the LRA, the staff requested the applicant to consider whether the proposed ISI and chemistry programs would be adequate for managing the aging effect of cracking of the control element drive mechanism (CEDM) housings at FCS. In response to RAI 3.1.1-4, the applicant indicated that in 1999, it began a proactive approach to dealing with the CRD housing cracking phenomenon by establishing a CEDM Material Reliability Management Plan to monitor the CEDMs on an outage-by-outage basis through the performance of eddy current testing of the CRDs. Details of the OPPD approach are contained in a letter from OPPD (R. L. Phelps) to NRC (Document Control Desk), dated January 25, 2002, "Fort Calhoun Station (FCS) Discussion of Control Element Drive Mechanism (CEDM) Housing Reliability" (LIC-02-0007), and in a letter from OPPD (R. L. Phelps) to NRC (Document Control Desk), dated October 15, 2001, "Fort Calhoun Station (FCS) CEDM Housing Reliability Management" (LIC-01-0095).

The applicant considers this to be a CLB issue, with the resolution to be incorporated into the appropriate AMPs. The applicant indicates that it will continue to be involved in industry/regulatory activities relative to this issue, and will apply recommended or mandated activities to the maintenance of the FCS CEDM housings as applicable. By letter dated February 20, 2003, the staff issued POI-8(f) requesting the applicant to include a description of the program to manage CEDM housings in the USAR Supplement. By letter dated March 14, 2003, the applicant committed to apply recommended or mandated activities resulting from the CRD Material Reliability Management Plan with regard to management of CEDM housings. The applicant's commitment to apply recommended or mandated activities resulting from the CRD Material Reliability Management Plan ensures that CEDM housings will receive adequate aging management during the license renewal term. The applicant committed to submit a revised AMP and associated USAR Supplement prior to the period of extended operation to ensure that the revised AMP and USAR Supplement are adequate to manage the aging of the CEDM housings. POI-8(f) is resolved.

The staff reviewed the USAR Supplement for the ISI program and finds that, based on the applicant's commitments described above, the USAR provides an adequate summary description of the AMP to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that, based on the applicant's commitments described above, the applicant has adequately evaluated the management of cracking in CRD housings.

3.1.2.1.2 Crack Initiation and Growth Due to Cyclic Loading of Pressurizer Integral Support

In response to RAI 3.1.2-6, the applicant indicated that this aging effect is not applicable for the FCS pressurizer integral supports because the terminology does not correspond to that used for FCS. However, in the response to this RAI, the applicant indicated that the aging management of the support skirt should have been included, and now includes cracking for the low alloy steel welds between the two low-alloy steel sections of the support skirt and between the support skirt and the low alloy steel pressurizer. The FCS ISI program inspects these welds. FCS is, therefore, consistent with GALL Report line items IV.C2.5-v (the only difference being that the GALL Report includes materials of carbon steel or stainless steel while the FCS skirt is low-alloy steel). Since the aging effects and aging management program are consistent with GALL, the AMR is acceptable.

The staff also reviewed the USAR Supplement for this aging management program and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of crack initiation and growth due to cyclic loading of the pressurizer integral support.

3.1.2.1.3 Loss of Preload Due to Stress Relaxation of CE Bolts and Tie Rods in Reactor Internals

The applicant indicates that its program is not consistent with GALL because it does not credit loose parts monitoring. The applicant's AMP for managing loss of preload due to stress relaxation of CE bolts and tie rods in reactor internals is the ISI program. The staff considers the ISI program adequate for loss of preload due to stress relaxation of CE bolts and tie rods because the program has been successful during the current term and should be successful during the license renewal period. The applicant discusses the adequacy of this program in response to RAI 3.1.3-1 and additional discussion of this issue is contained in SER Section

3.1.2.3.2, in which the staff evaluates the reactor vessel internals inspection (RVII) AMP. In its evaluation of this AMP, the staff reviewed CE reports on baffle former bolting and control element assembly (CEA) shroud bolts, and concluded that augmented examination of bolting in FCS reactor vessel internals is not necessary.

The staff reviewed the USAR Supplement for the ISI program and concludes that it provides an adequate summary description of the program and activities credited for managing loss of preload due to stress relaxation of CE bolts and tie rods in reactor internals to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that, the applicant has adequately evaluated the management of loss of preload due to stress relaxation of CE bolts and tie rods in reactor internals.

3.1.2.1.4 Conclusions

On the basis of its review of the inspection results the staff finds that the applicant's claim of consistency with GALL is acceptable, and that it is acceptable for the applicant to reference the information in the GALL Report for reactor system components. Therefore, on this basis, the staff concludes that, for those components that are managed consistent with the GALL Report, the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the USAR Supplement for the ISI program, including the applicant's commitments discussed above, and concludes that the supplement provides an adequate summary description of the programs and activities credited for managing the effects of aging for the reactor system components, as required by 10 CFR 54.21(d).

3.1.2.2 Aging Management Evaluations in the GALL Report That Are Relied on for License Renewal, For Which GALL Recommends Further Evaluation

For component groups evaluated in GALL for which the applicant has claimed consistency with GALL, and for which GALL recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues for which GALL recommended further evaluation. In addition, the staff sampled components in these groups during the AMR inspection to determine whether the plant-specific components contained in these GALL component groups were bounded by the GALL evaluation. The results of the staff's AMR inspection can be found in Inspection Report 50-285/03-07, dated March 20, 2003.

The GALL Report indicates that further evaluation should be performed for the aging effects described in the following sections:

3.1.2.2.1 Cumulative Fatigue Damage

As stated in the SRP-LR, fatigue is a time-limited aging analysis (TLAA) as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The staff reviewed the evaluation of this TLAA in Section 4.3 of this SER, following the guidance in Section 4.3 of the SRP-LR.

On the basis of the staff's review of LRA Section 4.3, the staff concludes that the components in the reactor systems subject to fatigue will be adequately managed during the period of extended operation.

3.1.2.2.2 Loss of Material Due to Pitting and Crevice Corrosion

As stated in the SRP-LR, loss of material due to pitting and crevice corrosion could occur in the PWR steam generator shell assembly. The existing program relies on control of chemistry to mitigate corrosion and ISI to detect loss of material. The extent and schedule of the existing steam generator inspections are designed to ensure that flaws cannot attain a depth sufficient to threaten the integrity of the welds. However, according to NRC Information Notice (IN) 90-04, "Cracking of the Upper Shell-to-Transition Cone Girth Welds in Steam Generators," dated January 26, 1990, if pitting and crevice corrosion of the shell exists, the program may not be sufficient to detect pitting and corrosion. The GALL Report recommends augmented inspection to manage this aging effect. The staff review verifies that the applicant has proposed a program that will manage loss of material due to pitting and crevice corrosion by providing enhanced inspection and supplemental methods to detect loss of material and ensure that the component intended function will be maintained during the period of extended operation.

In response to RAI 3.1.1-1, the applicant indicates that the pitting and crevice corrosion discussed in IN 90-04 is applicable to Westinghouse Model 44 and Model 51 vertical, recirculation, U-tube steam generators with feedwater ring design. FCS has Combustion Engineering steam generators. Based on an evaluation from CE, the applicant concluded that the shell-to-cone girth welds at FCS will not be susceptible to cracking similar to that identified in IN 90-04.

The applicant proposed the ISI (B.1.6), chemistry (B.1.2), and steam generator (B.2.9) programs to manage loss of material due to pitting and crevice corrosion in the steam generator shell assembly. The ISI program is reviewed in SER Section 3.0.3.5. The chemistry program is reviewed in SER Section 3.0.3.2. The steam generator program is reviewed in SER Section 3.1.2.3.3. In addition, in response to RAI B.2.9-2, the applicant indicates that the secondary shell, secondary handholds, secondary head, secondary manway, and transition cone are visually inspected for loss of material (general, pitting, and crevice corrosion) to ensure pressure boundary integrity. This RAI response is discussed in greater detail in SER Section 3.1.2.3.3.2.2.

The staff reviewed the USAR Supplement for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for the reactor system components for which the applicant claimed consistency with GALL, as required by 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of loss of material due to pitting and crevice corrosion, as recommended in the GALL Report.

3.1.2.2.3 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement

As stated in the SRP-LR, certain aspects of neutron irradiation embrittlement are TLAAs, as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with

10 CFR 54.21(c)(1). The staff reviewed the evaluation of this TLAA separately using the guidance in Section 4.2 of the SRP-LR. The results of the staff's review can be found in Section 4.2 of this SER.

Loss of fracture toughness due to neutron irradiation embrittlement could occur in the reactor vessel. A reactor vessel materials surveillance program monitors neutron irradiation embrittlement of the reactor vessel. Reactor vessel surveillance programs are plant-specific, depending on matters such as the composition of limiting materials, availability of surveillance capsules, and projected fluence levels. In accordance with 10 CFR Part 50, Appendix H, an applicant is required to submit its proposed withdrawal schedule for approval prior to implementation. Thus, the GALL Report recommends further evaluation of the reactor vessel materials surveillance program for the period of extended operation.

The applicant's reactor vessel material surveillance program is documented in the reactor vessel integrity program (RVIP) (B.1.7), and Section 4.2 of the program basis document for RVIP. The RVIP is reviewed in SER section 3.1.2.3.1. The surveillance capsule withdrawal schedule was submitted for staff review in a letter from OPPD dated November 8, 2001. The purpose of the submittal was to modify the surveillance capsule withdrawal schedule to reflect the renewal license period of 60 years. In a letter dated May 2, 2002, the staff indicated that the revised withdrawal schedule is acceptable for the renewal period of 60 years.

The staff reviewed the USAR Supplement for the RVIP AMP and concludes that it provides an adequate summary description of the programs and activities credited for managing the effects of aging for the reactor system components for which the applicant claimed consistency with GALL, as required by 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of fracture toughness due to neutron irradiation embrittlement for components in the reactor systems, as recommended in the GALL Report.

3.1.2.2.4 Crack Initiation and Growth Due to Thermal and Mechanical Loading or Stress Corrosion Cracking

As stated in the SRP-LR, crack initiation and growth due to thermal and mechanical loading or SCC (including intergranular stress corrosion cracking (IGSCC)) could occur in the small-bore reactor coolant system and connected system piping less than nominal pipe size (NPS) of 4 inches. The existing program relies on the ASME Section XI ISI and on control of water chemistry to mitigate SCC. The GALL Report recommends that a plant-specific destructive examination or a non-destructive evaluation (NDE) that permits inspection of the inside surfaces of the piping be conducted to ensure that cracking has not occurred and the component intended function will be maintained during the period of extended operation. The AMPs should be augmented by verifying that service-induced weld cracking is not occurring in the small-bore piping less than NPS 4 inches, including pipe, fittings, and branch connections. A one-time inspection of a sample of locations is an acceptable method to ensure that the aging effect is not occurring and that the component's intended function will be maintained during the period of extended operation. GALL Chapter XI.M32, "One-Time Inspection," contains an acceptable verification method.

The GALL Report recommends that the inspection include a representative sample of the system population, and, where practical and prudent, focus on the bounding or lead components most susceptible to aging due to time in service, severity of operating conditions, and lowest design margin. For small-bore piping, actual inspection locations should be based on physical accessibility, exposure levels, NDE techniques, and locations identified in IN 97-46, "Unisolable Crack in High-Pressure Injection Piping." Combinations of NDE, including visual, ultrasonic, and surface techniques, are performed by qualified personnel following procedures consistent with the ASME Code and 10 CFR 50, Appendix B. For small-bore piping less than NPS 4 inches, including pipe, fittings, and branch connections, a plant-specific destructive examination or NDE that permits inspection of the inside surfaces of the piping should be conducted to ensure that cracking has not occurred. Followup of unacceptable inspection findings should include expansion of the inspection sample size and locations. The inspection and test techniques prescribed by the program should verify any aging effects because these techniques, used by qualified personnel, have been proven effective and consistent with staff expectations. The staff's review confirms that the program includes measures to verify that unacceptable degradation is not occurring, thereby validating the effectiveness of existing programs, or confirming that there is no need to manage aging-related degradation for the period of extended operation. If an applicant proposes a one-time inspection of select components and susceptible locations to ensure that corrosion is not occurring, the reviewer verifies that the proposed inspection will be performed using techniques similar to ASME Code and American Society for Testing and Materials (ASTM) standards, including visual, ultrasonic, and surface techniques, to ensure that the component's intended function will be maintained during the period of extended operation.

The GALL Report recommends that a plant-specific AMP be evaluated for the management of crack initiation and growth due to thermal and mechanical loading or SCC (including IGSCC) in a boiling-water reactor (BWR) reactor vessel flange leak detection line and BWR jet pump sensing line. Since reactor vessel flange leak detection lines are also utilized in PWRs, this issue is applicable to PWRs. The staff reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of these aging effects. Acceptance criteria are described in BTP RLSB-1 (Appendix A.1 of the SRP).

The applicant has proposed the ISI (B.1.6), chemistry (B.1.2), and one-time inspection (B.3.5) programs to manage cracking of the small-bore RCS and connected system piping. The ISI program is reviewed in SER Section 3.0.3.5. The chemistry program is reviewed in SER section 3.0.3.2. The one-time inspection program is reviewed in SER Section 3.0.3.13. The ISI program is consistent with XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," as identified in the GALL Report. ASME Code Section XI, Subsection IWB, requires surface and VT-2 visual examination. However, these examination methods will not be able to detect a crack initiating from the inside surface that is not through-wall. In order to detect a crack initiating from the inside surface that is not through-wall, a volumetric examination is required.

The FCS chemistry program is consistent with XI.M2, "Water Chemistry," as identified in the GALL Report. This program will mitigate damage caused by stress corrosion through periodic monitoring and control of known detrimental contaminants. The FCS one-time inspection program will be consistent with XI.M32, "One-Time Inspections," as identified in the GALL Report prior to the period of extended operation. This program specifies that the inside surface of piping be examined by either performing destructive examination or NDE. The NDE must permit inspection of the inside surface of the piping. NDE using volumetric examination methods can be performed from the outside and would be able to detect cracking initiating from the inside surface. During its inspection and audit conducted from January 6-10, 2003, and from January 20-23, 2003, the staff confirmed that the applicant's one-time inspection program will include volumetric examination and will inspect locations that are susceptible to SCC or thermal cycling. The results of the staff's inspection and audit are documented in AMR Inspection Report 50-285/03-07, dated March 20, 2003, and audit report dated April 9, 2003. Additional discussion of the one-time inspection program is contained in Section 3.0.3.13 of this SER.

Leakage detection lines, or closure head vent lines, have been included within the scope of license renewal and are addressed in LRA Table 2.3.1.3-1 under the component type "Pipes & Fittings, CEDM Housings." The applicable components are linked to AMR results Items 3.1.1.01, 3.1.1.06, and 3.1.1.24. Item A2.1.4 in Section IV of the GALL Report indicates vessel flange leak detection lines require further plant-specific evaluation. Since this line functions as a pressure boundary for the vessel flange, by letter dated February 20, 2003, the staff issued POI-8(a), requesting the applicant to address the plant-specific review in item A2.1.4 in Section IV of The GALL Report. In addition, the staff asked the applicant to identify the materials used in the leakage detection line, the method of pressurizing the lines, and the inspection methods that are used to detect crack initiation and growth due to SCC that initiates on the inside surface. By letter dated March 14, 2003, the applicant addressed this POI by stating that AMR Item 3.1.1.06 is equivalent to GALL Report Item IV.A2.1.4. AMR Item 3.1.1.06 specifies in discussion item 3 that the lines are fabricated from stainless steel. Discussion item 2 specifies that the chemistry, ISI, and one-time inspection programs are to be used to manage the aging of these lines. The one-time inspection program will be used to verify that weld cracking is not occurring. This is consistent with the GALL Report (IV.C1.1.13, IV.C2.1.5, and IV.C2.2.8). The applicant is treating these lines in the same manner as other small-bore RCS lines.

On the basis of its review of the information provided in the POI response, the staff finds that the applicant's response, including its commitment to use the one-time inspection program to confirm that weld cracking is not occurring, is adequate to ensure that the reactor vessel flange leakage detection lines will be adequately managed during the period of extended operation. POI-8(a) is resolved.

The staff reviewed the USAR Supplements for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for the reactor system components for which the applicant claimed consistency with GALL, as required by 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of crack initiation and growth due to thermal and mechanical loading or stress corrosion cracking for small-bore piping and reactor vessel flange leak detection lines in the reactor systems, as recommended in the GALL Report.

3.1.2.2.5 Crack Growth Due to Cyclic Loading

As stated in the SRP-LR, crack growth due to cyclic loading could occur in the reactor vessel shell and RCS piping and fittings. Growth of intergranular separations (underclad cracks) in low-alloy or carbon steel heat-affected zones under austenitic stainless steel cladding is a TLAA to be evaluated for the period of extended operation for all the SA 508, Class 2 forgings where the cladding was deposited with a high heat input welding process. The methodology for evaluating the underclad flaw should be consistent with the current, well-established flaw evaluation procedure and criterion in the ASME Section XI Code. Section 4.7, “Other Plant-Specific Time-Limited Aging Analysis,” of the SRP-LR provides generic guidance for meeting the requirements of 10 CFR 54.21(c). The GALL Report recommends further evaluation of programs to manage crack growth due to cyclic loading in the reactor vessel shell and RCS piping and fittings. The GALL Report states that this aging effect is only applicable for the reactor vessel shell if it is made of SA 508, Class 2 forgings and is exposed to a neutron fluence greater than 10^{17} n/cm^2. The applicant indicates that this aging effect is not applicable to FCS.

In response to RAI 3.1.1-2, the applicant indicates that the only reactor vessel components fabricated of SA 508, Class 2 steel and clad with a stainless steel or a nickel-based alloy weld overlay, are the reactor vessel flange, closure head flange, and the primary coolant nozzles, nozzle extensions, and nozzle safe ends. A recent Westinghouse analysis performed for FCS indicates the flanges and nozzles will not experience a fluence greater than 10^{17} n/cm^2 by the end of the period of extended operation. Based on its experience with neutron flux in regions outside the beltline, the staff agrees that the neutron fluence at the flange and nozzles will be less than 10^{17} n/cm^2. In addition, the applicant indicates that Westinghouse/CE indicated to the applicant that there have been no cases of underclad cracking of any clad CE reactor vessel subcomponents. Based on this information, the staff concludes that this aging effect does not need to be managed during the period of extended operation.

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of crack growth due to cyclic loading for components in the reactor systems, as recommended in the GALL Report.

3.1.2.2.6 Changes in Dimension Due to Void Swelling (PWR)

As stated in the SRP-LR, changes in dimension due to void swelling could occur in reactor internal components. The GALL Report recommends further evaluation to ensure that this aging effect is adequately managed. The reactor vessel internals receive a visual inspection (VT-3) according to Category B-N-3 of Subsection IWB of ASME Section XI. However, this inspection is not sufficient to detect the effects of changes in dimension due to void swelling. Therefore, GALL recommends that a plant-specific AMP be evaluated. The applicant should provide a plant-specific AMP or participate in industry programs to investigate aging effects and determine an appropriate AMP. Otherwise, the applicant should provide the basis for concluding that void swelling is not an issue for the component. The staff verifies that the applicant has either proposed a program to manage changes in dimension due to void swelling in the pressure vessel internal components, or provided the basis for concluding that void swelling is not an issue.

The applicant has not indicated that void swelling is not an issue. The applicant has proposed to manage this aging effect by the RVII program (B.2.8). This program is reviewed in SER Section 3.1.2.3.2. The RVII program references GALL programs XI.M13, “Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS),” and XI.M16, “PWR Vessel Internals,” as identified in the GALL Report. These GALL sections identify programs that are acceptable to the staff for managing void swelling. Since the applicant has proposed a program to manage this aging effect, the applicant has provided the additional information requested in the SRP-LR.

The staff reviewed the USAR Supplement for the RVII program and concludes that it provides an adequate summary description of the programs and activities credited for managing the effects of aging for the reactor system components for which the applicant claimed consistency with GALL, as required by 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of changes in dimension due to void swelling for reactor vessel internals components, as recommended in the GALL Report.

3.1.2.2.7 Crack Initiation and Growth Due to Stress Corrosion Cracking or Primary Water Stress Corrosion Cracking

As stated in the SRP-LR, crack initiation and growth due to SCC and PWSCC could occur in PWR core support pads (or core guide lugs), instrument tubes (bottom head penetrations), pressurizer spray heads, and nozzles for the steam generator instruments and drains. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed. The GALL Report also recommends that a plant-specific AMP be evaluated because existing programs may not be capable of mitigating or detecting crack initiation and growth due to SCC. Acceptance criteria are described in BTP RLSB-1 (Appendix A.1 of the SRP-LR). The staff reviewed the applicant's proposed program to ensure that an adequate program will be in place for the management of these aging effects.

Crack initiation and growth due to SCC could occur in PWR CASS RCS piping and fittings and the pressurizer surge line nozzle. The GALL Report recommends further evaluation of piping that do not meet either the reactor water chemistry guidelines of TR-105714, "PWR Primary Water Chemistry Guidelines-Revision 3," November 1995, or material guidelines of NUREG-0313, Revision. 2, "Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping." Acceptance criteria are described in BTP RLSB-1 (Appendix A.1 of the SRP-LR). The staff reviewed the applicant's proposed program to ensure that an adequate program will be in place for the management of these aging effects.

Crack initiation and growth due to PWSCC could occur in PWR pressurizer instrumentation penetrations and heater sheaths and sleeves made of nickel alloys. The existing program relies on the ASME Section XI ISI and on control of water chemistry to mitigate PWSCC. However, the existing program should be augmented to manage the effects of SCC on nickel-alloy components. The GALL Report recommends that the applicant provide a plant-specific AMP or participate in industry programs to determine an appropriate AMP for PWSCC of Alloy 600 and Inconel 82/182 welds. Acceptance criteria are described in BTP RLSB-1 (Appendix A.1 of the SRP-LR). The staff reviewed the applicant's proposed program to ensure that an adequate program will be in place for the management of these aging effects.

The applicant has proposed to manage crack initiation and growth due to SCC or PWSCC for core support pads, instrument tubes (bottom head penetrations), pressurizer spray heads and nozzles for the steam generator instruments and drains using the Alloy 600 program (B.3.1). This program is evaluated in SER Section 3.1.2.3.4. The Alloy 600 program references GALL program XI.M11, “Nickel-Alloy Nozzles and Penetrations,” as identified in the GALL Report. This GALL section identifies programs that are acceptable to the staff for managing crack initiation and growth due to SCC or PWSCC.

The applicant has proposed to manage crack initiation and growth due to SCC in CASS RCS piping using the chemistry (B.1.2), ISI (B.1.6), and thermal embrittlement of CASS (B.3.7) programs. The ISI program is reviewed in SER Section 3.0.3.5. The chemistry program is reviewed in SER Section 3.0.3.2. The thermal embrittlement of CASS program is reviewed in SER Section 3.1.2.3.5. The FCS chemistry program is consistent with GALL program XI.M32, “Water Chemistry,” as identified in the GALL Report. This program will mitigate damage caused by stress corrosion through periodic monitoring and control of known detrimental contaminants. GALL program XI.M2 indicates that the primary water chemistry program is based on the EPRI guidelines in TR-105714. Since the proposed program is consistent with EPRI guidelines in TR-105714, the applicant has proposed an acceptable program to manage this aging effect and the applicant has provided the additional information requested in the SRP-LR.

The applicant has proposed to manage crack initiation and growth due to PWSCC in pressurizer instrumentation penetrations and heater sheaths and sleeves made of nickel-alloys by the Alloy 600 (B.3.1), chemistry (B.1.2), and ISI (B.1.6) programs. The ISI program is reviewed in SER Section 3.0.3.5. The chemistry program is reviewed in SER Section 3.0.3.2. The Alloy 600 program is reviewed in SER Section 3.1.2.3.4. The Alloy 600 program references GALL program XI.M11, “Nickel-Alloy Nozzles and Penetrations,” as identified in the GALL Report. This GALL section identifies programs that are acceptable to the staff for managing crack Initiation and growth due to SCC or PWSCC.

The staff reviewed the USAR Supplement for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for the reactor system components for which the applicant claimed consistency with GALL, as required by 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of crack initiation and growth due to SCC or PWSCC for components in the reactor systems, as recommended in the GALL Report.

3.1.2.2.8 Crack Initiation and Growth Due to Stress Corrosion Cracking or Irradiation-Assisted Stress Corrosion Cracking

As stated in the SRP-LR, crack initiation and growth could occur in baffle/former bolts due to SCC or irradiation-assisted stress corrosion cracking (IASCC) in Westinghouse and B&W reactors. FCS is a CE reactor and therefore this issue does not apply.

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of crack initiation and growth due to SCC or IASCC for baffle/former bolts, as recommended in the GALL Report.

3.1.2.2.9 Loss of Preload Due to Stress Relaxation

As stated in the SRP-LR, loss of preload due to stress relaxation could occur in baffle/former bolts in Westinghouse and B&W reactors. Loss of preload on baffle/former bolts is due to neutron irradiation and could occur in components that are susceptible to SCC or IASCC. Since baffle/former bolts in CE reactors are not susceptible to SCC or IASCC, they would not be susceptible to loss of preload due to stress relaxation. FCS is a CE reactor and therefore this issue does not apply.

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of preload due to stress relaxation for components in the reactor systems, as recommended in the GALL Report.

3.1.2.2.10 Loss of Section Thickness due to Erosion

As stated in the SRP-LR, loss of section thickness due to erosion could occur in steam generator feedwater impingement plates and supports. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed. Acceptance criteria are described in BTP RLSB-1 (Appendix A.1 of this SRP). The staff reviewed the applicant’s proposed program to ensure that an adequate program will be in place for the management of this aging effect.

The applicant indicates that this aging effect is not applicable because FCS does not utilize impingement plates and supports for supplying feedwater to the steam generators. By letter dated February 20, 2003, the staff issued POI-8(b), requesting the applicant to clarify whether FCS has steam generator feedwater impingement plates and supports. By letter dated March 14, 2003, the applicant directed the staff to LRA AMR Item 3.1.1.14. On the basis of the applicant’s response to POI-8(b), the staff finds that feedwater is supplied to steam generators through the steam generator feedwater feed ring. The steam generator feedwater feed ring is susceptible to cumulative fatigue and loss of material. Based on plant operating experience, it is not susceptible to loss of section thickness due to erosion. Since FCS does not utilize impingement plates and associated supports, and the steam generator feedwater feed ring is not susceptible to loss of section thickness due to erosion, this aging effect is not applicable to FCS. POI-8(b) is resolved.

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of section thickness due to erosion for components in the reactor systems, as recommended in the GALL Report.

3.1.2.2.11 Crack Initiation and Growth Due to PWSCC, ODSCC, or Intergranular Attack, or Loss of Material Due to Wastage and Pitting Corrosion, or Loss of Section Thickness Due to Fretting and Wear, or Denting Due to Corrosion at Carbon Steel Tube Support Plate Intersections

As stated in the SRP-LR, crack initiation and growth due to PWSCC, outside diameter stress corrosion cracking (ODSCC), or intergranular attack (IGA) or loss of material due to wastage and pitting corrosion or deformation due to corrosion could occur in Alloy 600 components of the steam generator (SG) tubes, repair sleeves, and plugs. The GALL Report recommends further evaluation of (1) crack initiation and growth due to PWSCC, ODSCC, or IGA or (2) loss of material due to wastage and pitting corrosion or (3) deformation due to corrosion in Alloy 600 components of the SG tubes, repair sleeves, and plugs. All PWR licensees have committed voluntarily to an SG degradation management program described in NEI 97-06, “Steam Generator Program Guidelines.” The GALL Report recommends that an AMP based on the recommendations of staff-approved NEI 97-06 guidelines, or some other alternate regulatory basis for SG degradation management, be developed to ensure that this aging effect is adequately managed. At present, the staff does not plan to endorse NEI 97-06 or detailed industry guidelines referenced therein. The staff is working with the industry to revise plant technical specifications to incorporate the essential elements of the industry’s NEI 97-06 initiative as necessary to ensure tube integrity is maintained. This would require implementation of programs to ensure that performance criteria for tube structural and leakage integrity are maintained, consistent with the plant design and licensing basis. NEI 97-06 provides guidance on programmatic details for accomplishing this objective. These guidelines apply to all degradation or damage mechanisms. However, these programmatic details would be outside the scope of the technical specifications. As part of the NRC Reactor Oversight Program, NRC would monitor the effectiveness of these programs in terms of whether the goals of these programs are being met, particularly whether the tube structural and leakage integrity performance criteria are being maintained. The staff reviewed the applicant’s proposed program to ensure that an adequate program will be in place for the management of these aging effects for the period of extended operation.

The applicant has proposed to manage (1) crack initiation and growth due to PWSCC, ODSCC, or intergranular attack, or (2) loss of material due to wastage and pitting corrosion, or (3) loss of section thickness due to fretting and wear, or (4) denting due to corrosion of carbon steel tube support plate intersections by the steam generator (B.2.9) and chemistry (B.1.2) programs. The chemistry program is reviewed in SER Section 3.0.3.2. The steam generator program (SGP) is reviewed in SER Section 3.1.2.3.3. These aging effects are discussed in greater detail in SER Section 3.1.2.3.3.2.4.

The staff reviewed the USAR Supplement for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for the reactor system components for which the applicant claimed consistency with GALL, as required by 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of (1) crack initiation and growth due to PWSCC, ODSCC, or intergranular attack, or (2) loss of material due to wastage and pitting corrosion, or (3) loss of section thickness due to fretting and wear, or (4) denting due to corrosion at carbon steel tube support plate intersections, as recommended in the GALL Report.

3.1.2.2.12 Loss of Section Thickness Due to Flow-Accelerated Corrosion

As stated in the SRP-LR, loss of section thickness due to FAC could occur in tube support lattice bars made of carbon steel. The GALL Report recommends further evaluation of loss of section thickness due to flow-accelerated corrosion of the tube support lattice bars made of carbon steel. The GALL Report recommends a plant-specific AMP be evaluated and, on the basis of the guidelines of NRC Generic Letter 97-06, an inspection program for SG internals be developed to ensure that this aging effect is adequately managed. The staff reviewed the applicant’s proposed program to ensure that an adequate program will be in place for the management of these aging effects. Acceptance criteria are described in BTP RLSB-1 (Appendix A.1 of the SRP-LR).

Loss of section thickness due to FAC in tube support lattice bars made of carbon steel is managed by the SGP (B.2.9). The applicant's SGP is reviewed in SER Section 3.1.2.3.3. This aging effect is discussed in greater detail in SER Section 3.1.2.3.3.2.5.

The staff reviewed the USAR Supplement for the SG program and concludes that it provides an adequate summary description of the programs and activities credited for managing the effects of aging for the reactor system components for which the applicant claimed consistency with GALL, as required by 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of section thickness due to FAC for components in the reactor systems, as recommended in the GALL Report.

3.1.2.2.13 Ligament Cracking Due to Corrosion

As stated in the SRP-LR, ligament cracking due to corrosion could occur in the carbon steel SG tube support plate. The GALL Report recommends further evaluation of ligament cracking due to corrosion in carbon steel components in the SG tube support plate. All PWR licensees have committed voluntarily to an SG degradation management program described in NEI 97-06. The GALL Report recommends that an AMP based on the recommendations of staff-approved NEI 97-06 guidelines, or some other alternate regulatory basis for SG degradation management, be developed to ensure that this aging effect is adequately managed. At present, the staff does not plan to endorse NEI 97-06 or detailed industry guidelines referenced therein. The staff is working with the industry to revise plant technical specifications to incorporate the essential elements of the industry's NEI 97-06 initiative as necessary to ensure tube integrity is maintained. This would require implementation of programs to ensure that performance criteria for tube structural and leakage integrity are maintained, consistent with the plant design and licensing basis. NEI 97-06 provides guidance on programmatic details for accomplishing this objective. These guidelines apply to all degradation or damage mechanisms. However, these programmatic details would be outside the scope of the technical specifications. As part of the NRC Reactor Oversight Program, NRC would monitor the effectiveness of these programs in terms of whether the goals of these programs are being met particularly whether the tube structural and leakage integrity performance criteria are being maintained. The staff reviewed the applicant's proposed program to ensure that an adequate program will be in place for the management of these aging effects.

Ligament cracking due to corrosion which could occur in the carbon steel steam generator tube support plate is managed by the SG (B.2.9) and chemistry (B.1.2) programs. The chemistry program is reviewed in SER Section 3.0.3.2. The SGP is reviewed in SER Section 3.1.2.3.3. The FCS chemistry program is consistent with GALL program XI.M2, "Water Chemistry," as identified in the GALL Report. This program will mitigate damage caused by stress corrosion through periodic monitoring and control of known detrimental contaminants. This aging effect is discussed in greater detail in SER Section 3.1.2.3.3.2.6.

The staff reviewed the USAR Supplement for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for the reactor system components for which the applicant claimed consistency with GALL, as required by 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of ligament cracking due to corrosion for components in the reactor systems, as recommended in the GALL Report.

3.1.2.2.14 Loss of Material Due to Flow-Accelerated Corrosion

As stated in the SRP-LR, loss of material due to FAC could occur in the feedwater inlet ring and supports. The GALL Report recommends that a plant-specific AMP be evaluated to manage loss of material due to FAC in these components. As noted in IN 90-04, “Cracking of the Upper Shell-to-Transition Cone Girth Welds in Steam Generators,” IN 91-19, "Steam Generator Feedwater Distribution Piping Damage," and licensee event report (LER) 50-362/90-05-01, this form of degradation has been detected only in certain CE System 80 steam generators. The GALL Report recommends that a plant-specific AMP be evaluated because existing programs may not be capable of mitigating or detecting loss of material due to FAC. Acceptance criteria are described in BTP RLSB-1 (Appendix A.1 of the SRP). The staff reviewed the applicant’s proposed program to ensure that an adequate program will be in place for the management of these aging effects. However, since this aging effect is applicable only to System 80 plants, it is not applicable to FCS.

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of material due to FAC for components in the reactor systems, as recommended in the GALL Report.

3.1.2.2.15 Conclusions

The staff has reviewed the applicant’s evaluation of the issues for which GALL recommends further evaluation for components in the reactor systems. On the basis of its review, the staff concludes that the applicant has provided sufficient information to demonstrate that the issues for which GALL recommends further evaluation have been adequately addressed, and that the subject aging effects will be adequately managed for the period of extended operation, as required by 10 CFR 54.21(a)(3). In addition, the staff concludes that the applicant’s USAR Supplements provide adequate descriptions of the programs credited with managing these aging effects, as required by 10 CFR 54.21(d).

3.1.2.3 Aging Management Programs for Reactor Systems Components

In SER Sections 3.1.2.1 and 3.1.2.2, the staff determined that the applicant’s AMRs and associated AMPs will adequately manage component aging in the reactor systems. The staff then reviewed specific components in the reactor systems to ensure that they were properly evaluated in the applicant’s AMR.

To perform its evaluation, the staff reviewed the components listed in LRA Tables 2.3.1.1-1 through 2.3.1.3-1 to determine whether the applicant had properly identified the applicable AMRs and AMPs needed to adequately manage component aging effects. This portion of the staff review involved identification of the aging effects for each component, ensuring that each aging effect was evaluated using the appropriate AMR in Section 3, and that management of the aging effect was captured in the appropriate AMP. The results of the staff's review are provided below.

The staff also reviewed the USAR Supplements for the AMPs credited with managing aging in reactor system components to determine whether the program description adequately describes the program.

The applicant credits 12 AMPs to manage the aging effects associated with components in the reactor systems. Seven of the AMPs are credited for managing the aging of components in several system groups (common AMPs), while five AMPs are credited with managing aging only for reactor system components. The staff's evaluation of the common AMPs is provided in Section 3.0.3 of this SER. A list of the common AMPs follows.

- Bolting Integrity Program - SER Section 3.0.3.1
- Chemistry Program - SER Section 3.0.3.2
- Flow-Accelerated Corrosion Program - SER Section 3.0.3.4
- Inservice Inspection Program - SER Section 3.0.3.5
- Boric Acid Corrosion Prevention Program - SER Section 3.0.3.6
- Fatigue Monitoring Program - SER Section 3.0.3.8
- One-Time Inspection - SER Section 3.0.3.13

The staff's evaluation of the five reactor system AMPs is provided below.

3.1.2.3.1 Reactor Vessel Integrity Program

3.1.2.3.1.1 Summary of Technical Information in the Application

The applicant's reactor vessel integrity program (RVIP) is documented in Section B.1.7 of the LRA. The applicant states that the RVIP is consistent with GALL program XI.31, "Reactor Vessel Surveillance," as identified in the GALL Report, with the enhancement that the revised, optimized withdrawal and test schedule was submitted for review and approval per OPPD Letter LIC-01-0107 dated November 8, 2001. This AMP is credited for managing loss of fracture toughness due to neutron irradiation embrittlement of the reactor vessel beltline shell and welds.

3.1.2.3.1.2 Staff Evaluation

The staff reviewed the enhancement and its justification to determine whether the AMP, with the enhancement, remains adequate to manage the aging effects for which it is credited. The staff also reviewed the USAR Supplement to determine whether it provides an adequate description of the revised program. The staff further reviewed the applicant's evaluation to determine whether it addressed the additional issues recommended in the GALL Report, and confirmed that the AMP would adequately address these issues.

In LRA Section B.1.7, "Reactor Vessel Integrity Program," the applicant described its AMP to manage aging in the reactor vessel beltline shell and welds. The LRA stated that this AMP is consistent with GALL AMP XI.31, with an enhancement that the revised, optimized withdrawal and test schedule was submitted for review and approval per OPPD Letter LIC-01-0107 dated November 8, 2001. For this AMP, GALL recommends further evaluation. The proposed withdrawal schedule was reviewed and approved by the staff in a letter from S. Dembek (NRC) to R. T. Ridenoure (OPPD) dated May 2, 2002. In this letter, the staff found the revised withdrawal schedule acceptable for 60 years. In addition, the staff approved an integrated surveillance program for FCS as described in CEN-636, Revision 2, in a safety evaluation dated June 6, 2001. The use of the integrated surveillance program allows OPPD to utilize data originating from the surveillance programs at Mihama 1, Palisades, and Diablo Canyon Unit 1, to monitor neutron irradiation embrittlement to the FCS reactor vessel beltline. The weld materials in Mihama 1, Palisades, and Diablo Canyon Unit 1 surveillance capsules contain material that is representative of the weld materials in the FCS beltline. The staff review that was documented in letters dated June 6, 2001, and May 2, 2002, satisfies the SRP recommendation for further evaluation.

The applicant provided its USAR Supplement for the RVIP in Section A.2.19 of the LRA. The staff reviewed the USAR Supplement and finds that the summary description contains a sufficient level of information to satisfy 10 CFR 54.21(d), and is acceptable.

3.1.2.3.1.3 Conclusion

On the basis of its review of the applicant's program, the staff finds that those portions of the program for which the applicant claims consistency with GALL are consistent with GALL. In addition, the staff has reviewed the enhancements to the GALL program and finds that the applicant's program provides for adequate management of the aging effects for which the program is credited. The staff also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program to satisfy 10 CFR 54.21(d).

Therefore, on the basis of its review, the staff concludes that the applicant has demonstrated that the RVIP will effectively manage aging in the components for which this program is credited so that the intended functions of the associated components and systems will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3.2 Reactor Vessel Internals Inspection Program

3.1.2.3.2.1 Summary of Technical Information in the Application

The applicant's reactor vessel internals inspection (RVII) program is discussed in LRA Section B.2.8, "Reactor Vessel Internals Inspection Program." The applicant states that the program is consistent with GALL programs XI.M13, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)," and XI.M16, "PWR Vessel Internals," with the exception that no augmented inspection of bolting is scheduled and the chemistry-related portions of the program are addressed in the FCS chemistry program. The tensile stresses on the reactor vessel internals bolting are lower than the industry levels where cracking was observed as an aging effect. The applicant also states that fluence and stress analyses discussed in GALL programs XI.M13 and XI.M16 will be performed to identify critical locations. A fracture mechanics analysis for critical locations will be performed to determine flaw acceptance criteria and resolution required to detect flaws. Appropriate inspection techniques will be based on these analyses. This AMP is credited for managing change of dimension due to void swelling and crack initiation and growth due to SCC and IASCC in reactor vessel internals.

3.1.2.3.2.2 Staff Evaluation

In LRA Section B.2.8, the applicant described its AMP to manage aging in reactor internals. The LRA stated that this AMP is consistent with GALL AMPs XI.M13 and XI.M16 with the exception that no augmented inspection of bolting is scheduled and the chemistry-related portions of the program are addressed in the FCS chemistry program. For these AMPs, GALL recommends further evaluation. GALL XI. M13 indicates that an applicant can implement either a supplemental examination of the affected component as a part of the 10-year ISI program during license renewal, or a component-specific evaluation to determine the component's susceptibility to loss of fracture toughness. GALL XI.M16 further indicates that an applicant's program should identify the most limiting component, develop appropriate inspection techniques, and implement the inspections during the license renewal term. These recommendations have been satisfied since the applicant indicates that fluence and stress analyses discussed in GALL programs XI.M13 and XI.M16 will be performed to identify critical locations. A fracture mechanics analysis for critical locations will be performed to determine flaw acceptance criteria and resolution required to detect flaws. Appropriate inspection techniques will be based on these analyses.

The staff confirmed the applicant's claim of consistency during the AMR inspection. Furthermore, the staff reviewed the exceptions and their justification to determine whether the AMP, with the exceptions, remains adequate to manage the aging effects for which it is credited. The staff also reviewed the USAR Supplement to determine whether it provides an adequate description of the revised program. The staff further reviewed the applicant's evaluation to determine whether it addressed the additional issues recommended in the GALL Report and confirmed that the AMP would adequately address these issues.

For bolted components, GALL XI.M16 indicates that an augmented ISI is recommended to detect cracks between the bolt head and shank unless the applicant performs component-specific mechanical analyses to preclude cracking. In the "operating experiences" portion of the RVII program, the applicant provided an evaluation of the susceptibility of cracking in baffle former bolts and CEA shroud bolts. The Combustion Engineering Owners Group (CEOG) provided an assessment of the cracking of the baffle former bolts reported in foreign PWRs, including the potential impact of the cracking on domestic CE plants. The results are in CEOG Report CE NPSD-1098 for CEOG Task 1011, "Evaluation of the Applicability of Baffle Bolt Cracking to Ft. Calhoun and Palisades Internals Bolts," Final Report, Revision 0, April 1998. The most likely mechanism for the cracking of cold-worked 316 stainless steel baffle former bolts in foreign plants is IASCC. There are only two CE-designed plants (FCS and Palisades) that use bolts to attach the core shroud panels (i.e., the baffle plates) to the former plates. The report indicates that these bolts in FCS are less susceptible to IASCC because (1) the material used in these bolts is annealed 316 stainless steel, which is not cold-worked, (2) the bolt stress from preload, as a percentage of yield strength, is much less than the foreign PWRs that cracked, (3) the differential pressure across the core shroud panels does not result in tensile loads on the panel (i.e., the baffle bolts) during normal operation, and (4) the core shroud panel design allows for some flexing of the former plate relative to the core barrel, thus reducing the load on the panel bolts. Since CE NPSD-1098 was issued, cracking has been discovered in Point Beach baffle bolts. However, as with the foreign PWR experience, cracked bolts were highly stressed during preload, tensile stresses were applied during operation because of the Westinghouse design, and the bolts were fabricated with cold-worked 316 stainless steel. Based on the difference in the design, materials, and preload between the Point Beach and the foreign PWR that experienced baffle former bolt cracking, the FCS baffle former bolts are less susceptible to cracking and augmented inspection is not necessary.

SCC was identified in Babcock and Wilcox (B&W) lower thermal shield and lower core barrel bolts that were fabricated with Alloy A-286. Most of the failed bolts were highly stressed to at or above the yield strength. Although there have been no failures of CEA shroud bolts in CE-designed reactor vessel internals, there is a concern that SCC may occur since these bolts are fabricated with Alloy A-286. CE provided an evaluation of the stress level for these bolts in CEN-282, "Investigation and Evaluation of A286 Bolt Applications in CE's NSSS," September 1984. This report indicates that the operating stress levels are just below 32 Ksi. The stress concentration factor for the CEA shroud bolts is 2.06, leading to a local stress of approximately 66 Ksi. Yield strength for A-286 is about 115 Ksi, so the stress is approximately 60 percent of yield. Most of the failed B&W bolts had working stresses of approximately 65 Ksi and a local stress of 134 Ksi which is above the yield strength of the material. There were no failed bolts with working stresses of 35 Ksi. The conclusion of the report indicates a low probability for cracking of the CEA shroud bolts. Based on the difference in the operating stresses on the CEA shroud bolts and the failed B&W bolts, and the fact that there have been no failures of CEA shroud bolts in CE-designed reactor vessel internals, the staff concludes that the CEA shroud bolts are less susceptible to SCC and augmented inspection is not necessary.

The applicant provided its USAR Supplement for the RVII program in Section A.2.20 of the LRA. The staff reviewed the USAR Supplement and finds that the summary description contains a sufficient level of information to satisfy 10 CFR 54.21(d), and is acceptable.

3.1.2.3.2.3 Conclusion

On the basis of its review and inspection of the applicant's program, the staff finds that those portions of the program for which the applicant claims consistency with GALL are consistent with GALL. In addition, the staff has reviewed the exceptions and enhancements to the GALL program and finds that the applicant's program provides for adequate management of the aging effects for which the program is credited. The staff also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program to satisfy 10 CFR 54.21(d).

Therefore, on the basis of its review, the staff concludes that the applicant has demonstrated that the RVII program will effectively manage aging in the components for which this program is credited so that the intended functions of the associated components and systems 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 Steam Generator Program

3.1.2.3.3.1 Summary of Technical Information in the Application

The applicant's steam generator program (SGP) is discussed in LRA Section B.2.9, "Steam Generator Program." The applicant states that the program is consistent with GALL program XI.M19, "Steam Generator Tube Integrity," with the clarifications that the applicant has included aging management activities to address plant-specific AMP requirements identified in Table 3.1.1 of the LRA, and the enhancement that the applicant has added plant-specific components beyond those discussed in GALL and identified in Table 3.1.2 of the LRA, for which the SGP is identified as an AMP. The applicant also identified an enhancement which states that an annunciator response procedure for the loose parts monitor in the SG will be written.

This AMP is credited with managing aging in the SG shell assembly; SG tubes, repair sleeves, and plugs; tube support lattice bars made of carbon steel; carbon steel tube support plates; SG lower head and primary side tube sheet; secondary side of the tubesheet, SG feedwater, steam and instrument nozzles, and feedwater nozzle safe ends; SG steam nozzle safe end; and SG feed ring.

The applicant stated that management of SG aging effects has evolved and improved over the years based on industry experience. The applicant has adopted industry practices throughout the years and continues to do so. Past NRC inspections of this program cited sample plans and inspection evaluation as a strength. Only one noteworthy situation occurred at FCS. In 1984, a tube with ODSCC in the U-bend region of the SG ruptured. Re-evaluation of the eddy current data from the previous inspection indicated that flaws were present and had been missed during the data analysis due to human error. This situation was corrected and long-term corrective actions were implemented to prevent recurrence. Currently, the applicant's practices are state-of-the-art. The overall experience illustrates that the SGP is effective in managing aging.

3.1.2.3.3.2 Staff Evaluation

In LRA Section B.2.9, the applicant described its AMP to manage aging in SG components. The LRA stated that this AMP is consistent with GALL AMP XI.M19, with the exception that the applicant included aging management activities to address plant-specific AMP requirements identified in Table 3.1-1 of the LRA, and the applicant added plant-specific components, beyond those discussed in GALL and identified in Table 3.1-2 of the LRA, for which the SGP is identified as an AMP. The applicant also identified an enhancement which states that an annunciator response procedure for the loose parts monitor in the SG will be written prior to the period of extended operation. For this AMP, GALL recommends further evaluation. Furthermore, the staff reviewed the clarifications and enhancements, and the applicant's justifications, to determine whether the AMP remains adequate to manage the aging effects for which it is credited. The staff reviewed the USAR Supplement to determine whether it provides an adequate description of the revised program. The staff further reviewed the applicant's evaluation to determine whether it addressed the additional issues recommended in the GALL Report to confirm whether the AMP would adequately address these issues.

3.1.2.3.3.2.1 Annunciator Response Procedure Enhancement

The applicant's LRA indicates that an annunciator response procedure will be written for the loose parts monitor in the SG, which was identified as an enhancement to the SGP AMP. In RAI B.2.9-1, the staff stated that it was not clear why the SGP was being enhanced to write an annunciator response procedure for the loose parts monitor for the SG, since the LRA states that loose parts monitoring is not credited for aging management. In response to RAI B.2.9-1, the applicant states that it has committed to NEI 97-06, "Steam Generator Program Guidelines," which states, "Licensees should have alarm response procedures for the loose parts monitoring system." Therefore, the applicant credits the annunciator response procedure for NEI 97-06 compliance, not as an AMP. In addition, the applicant stated that they have an annunciator response procedure that complies with the guidance in NEI 97-06. The staff finds the response acceptable and considers this issue closed.

3.1.2.3.3.2.2 Loss of Material Due to Pitting and Crevice Corrosion

As stated in the SRP-LR, loss of material due to pitting and crevice corrosion could occur in the PWR SG shell assembly. The existing program relies on control of chemistry to mitigate corrosion, and ISI to detect loss of material. The extent and schedule of the existing SG inspections are designed to ensure that flaws cannot attain a depth sufficient to threaten the integrity of the welds. However, according to NRC IN 90-04, "Cracking of the Upper Shell-to-Transition Cone Girth Welds in Steam Generators," dated January 26, 1990, if general corrosion pitting of the shell exists, the program may not be sufficient to detect pitting and corrosion. The GALL Report recommends augmented inspection to manage this aging effect. The staff review verifies that the applicant has proposed a program that will manage loss of material due to pitting and crevice corrosion by providing enhanced inspection and supplemental methods to detect loss of material and ensure that the component intended function will be maintained during the period of extended operation.

In response to RAI 3.1.1-1, the applicant indicated that the pitting and crevice corrosion discussed in IN 90-04 is applicable to Westinghouse Model 44 and Model 51 vertical, recirculating, U-tube SGs with feedwater ring design. FCS has CE SGs. Based on an evaluation from CE, the applicant concluded that the shell-to-cone girth welds at FCS will not be susceptible to cracking that is similar to that identified in IN 90-04.

In addition, in response to RAI B.2.9-2, the applicant indicates that the secondary shell, secondary handholds, secondary head, secondary manway, and transitional cone are visually inspected for loss of material (general, pitting, and crevice corrosion) to ensure pressure boundary integrity. Since these components are made from the same material in the same environment, at least one of these components is "representatively" visually inspected each refueling outage. Scope is expanded based on a discovery of an unexpected change in degradation, where change is based on review of past inspections. Site operating experience indicates relatively little degradation relative to the thickness of these pressure boundaries. Furthermore, site Class Cleanliness Standards (see below) allow only a small amount of degradation before a condition report is required. The corrective action program (CAP) provides an acceptable means of review, evaluation, and corrective action. Therefore, the representative visual inspections are considered adequate aging management of these pressure boundaries.

The applicant stated that Class C Cleanliness Standards, required for the secondary side indicate that "Thin uniform rust or magnetite films, are acceptable. Scattered areas of rust are permissible provided that the area of rust does not exceed 15 square inches in 1 square foot on corrosion resistant alloys."

The applicant's RAI response did not include sufficient detail for the staff to determine whether the proposed inspection will provide ensure that this aging effect will be adequately managed during the period of extended operation for the following reasons:

(1) The applicant states that at least one of these components is "representatively" visually inspected each refueling outage. The applicant needed to explain what

"representatively" means in this context and the basis for the appropriateness of this level of inspection (i.e., sample size).

(2) To detect pitting and crevice corrosion, the visual inspection must be performed in accordance with specified requirements (e.g., ASME Code VT-1). The applicant needed to describe the method or technique (including codes and standards) used to perform the visual inspection.

(3) The applicant needed to specify the acceptance requirements utilized to analyze the condition of the component once a condition report is initiated, thus ensuring that the structure and component intended function(s) are maintained under all CLB design conditions during the period of extended operation.

By letter dated February 20, 2003, the staff issued POI-7(d)(1), requesting the applicant to address these issues. By letter dated March 14, 2003, the applicant responded to POI-7(d)(1) by stating that "representatively" implies that the item inspected bounds items that are not inspected. The manways and handholds are visually inspected each time. Since these components are all low-alloy steel in a deoxygenated treated water environment, and there is no site or industry experience with significant degradation to these components, then the inspection of the internal surfaces of the manways and handholds are representative of the other non-inspected items. A detailed crawl-through of the SG secondary side occurs and allows observation of other internal surfaces as well.

There is no specific industry standard for acceptance criteria established for visual inspections of the secondary side pressure boundary surfaces. The condition of the secondary side SG components is considered acceptable if the knowledgeable personnel responsible for the performance of the inspections determine that there is no evidence of damage or degradation sufficient to warrant further evaluation or performance of repair/replacement activities. Although inspections are not required to be performed in accordance with ASME VT-1 requirements, inspections are overseen by Quality Control personnel who are VT-1 qualified. OPPD continues to perform these secondary side pressure boundary inspections as presented in OPPD's response to GL 97-06, dated March 25, 1998. In the NRC closeout of that response, dated September 29, 1999, the staff found these inspection practices provided assurance that the SG internals are in compliance with the current licensing basis. NUREG/CR-6754 concluded that there are no near-term problems nor is there a need for any immediate change in the current SG internals inspections. Furthermore, these same components are inspected for loss of material at the weld locations by ultrasonic testing by the inservice inspection program. Since there is no site or industry experience with significant pressure boundary degradation, OPPD considers these inspections as adequate aging management for the period of extended operation.

The staff has reviewed the applicant's response to POI-7(d)(1) and finds it acceptable because (1) the response clarifies what a representative visual inspection entails and that the scope of the inspections is adequate to represent the population of components of concern, (2) the applicant clarified that there are no specific acceptance criteria used across the industry for visual inspections of secondary side pressure boundary surfaces and has provided information on the current activities used by FCS to manage aging of these surfaces, including inspector qualifications, and has noted the staff's approval of these activities, and (3) these activities will be continued during the period of extended operation. On this basis, POI-7(d)(1) is resolved.

The staff finds that the applicant has adequately evaluated the management of loss of material due to pitting and crevice corrosion for components in the reactor systems, including the SG shell assembly, as recommended in the GALL Report.

The staff also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program to satisfy 10 CFR 54.21(d).

3.1.2.3.3.2.3 Loss of Section Thickness Due to Erosion

As stated in the SRP-LR, loss of section thickness due to erosion could occur in SG feedwater impingement plates and supports. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed.

The applicant indicates that the components are not applicable to FCS. This item is further discussed in Section 3.1.2.2.10 of this SER.

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of section thickness due to erosion for components in the reactor systems, as recommended in the GALL Report.

3.1.2.3.3.2.4 Crack Initiation and Growth Due to PWSCC, ODSCC, or Intergranular Attack, or Loss of Material Due to Wastage and Pitting Corrosion, or Loss of Section Thickness Due to Fretting and Wear, or Denting Due to Corrosion of Carbon Steel Tube Support Plate

As stated in the SRP-LR, crack initiation and growth due to PWSCC, ODSCC, or IGA or loss of material due to wastage and pitting corrosion, or deformation due to corrosion, could occur in Alloy 600 components of the SG tubes, repair sleeves and plugs.

All PWR licensees have committed voluntarily to an SG degradation management program described in NEI 97-06, “Steam Generator Program Guidelines.” The GALL Report recommends that an AMP based on the recommendations of staff-approved NEI 97-06 guidelines, or some other alternate regulatory basis for SG degradation management, should be developed to ensure that this aging effect is adequately managed.

At present, the staff does not plan to endorse NEI 97-06 or detailed industry guidelines referenced therein. The staff is working with the industry to revise plant technical specifications to incorporate the essential elements of the industry’s NEI 97-06 initiative as necessary to ensure tube integrity is maintained. This would require implementation of programs to ensure that performance criteria for tube structural and leakage integrity are maintained, consistent with the plant design and licensing basis. NEI 97-06 provides guidance on programmatic details for accomplishing this objective. These guidelines apply to all degradation or damage mechanisms. However, these programmatic details would be outside the scope of the technical specifications.

As part of the NRC Reactor Oversight Program, the NRC would monitor the effectiveness of these programs in terms of whether the goals of these programs are being met, particularly whether the tube structural and leakage integrity performance criteria are being maintained.

The staff reviews the applicant's proposed program to ensure that an adequate program will be in place for the management of these aging effects for the period of extended operation.

The applicant has proposed to manage by the steam generator program (B.2.9) and the chemistry program (B.1.2) (1) crack initiation and growth due to PWSCC, ODSCC, or IGA, or (2) loss of material due to wastage and pitting corrosion, (3) loss of section thickness due to fretting and wear, or (4) denting due to corrosion of carbon steel tube support plates in the SG tubes, repair sleeves, and plugs. The staff's review of the steam generator program is discussed here. The staff's review of the chemistry program is discussed in Section 3.0.3.2. of this SER. In response to RAI B.2.9-1, the applicant indicated that the SGP is consistent with GALL program XI.19, "Steam Generator Tube Integrity Program," and with guidance contained in NEI 97-06.

The staff reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of (1) crack initiation and growth due to PWSCC, ODSCC, or IGA, or (2) loss of material due to wastage and pitting corrosion, (3) loss of section thickness due to fretting and wear, or (4) denting due to corrosion of carbon steel tube support plate in the SG tubes, repair sleeves and plugs, as recommended in the GALL Report.

3.1.2.3.3.2.5 Loss of Section Thickness Due to Flow-Accelerated Corrosion

As stated in the SRP-LR, loss of section thickness due to FAC could occur in tube support lattice bars made of carbon steel. The GALL Report recommends that a plant-specific AMP be evaluated and, on the basis of the guidelines of NRC GL 97-06, an inspection program for SG internals be developed to ensure that this aging effect is adequately managed. The staff reviewed the applicant's proposed program to ensure that an adequate program will be in place for the management of these aging effects for the period of extended operation.

Loss of section thickness due to FAC in tube support lattice bars made of carbon steel is managed by the SGP. In response to RAI B.2.9-2, the applicant indicated that tube supports (batwings, eggcrates, and vertical grids) are visually inspected for loss of material due to FAC, general, pitting, crevice, and galvanic corrosion. A portion of the batwings are inspected each refueling outage. In addition, in 1998, a remote video camera was used to video the peripheral eggcrate locations from three drop points, with nearly all eggcrate elevations inspected from each drop point. No degradation of the eggcrate tube supports was noted. Furthermore, eddy current testing (ECT) each refueling outage has not resulted in any indications of missing or severely damaged tube supports in the areas adjacent to the tubes. Because operation has continued for 29 years with insignificant degradation, and all these components are carbon steel in the same environment, visual examination (augmented by ECT) is adequate management of these tube supports for structural function.

The applicant's RAI response did not include sufficient detail for the staff to determine whether the proposed inspection will ensure that this aging effect will be adequately managed during the period of extended operation for the following reasons:

(1) The applicant indicates that tube supports (batwings, eggcrates, and vertical grids) are visually inspected for loss of material due to FAC, general, pitting, crevice, and galvanic corrosion, and that a portion of the batwings are inspected each refueling outage. It is not clear to the staff exactly what components (batwings, eggcrates and/or vertical grids) are inspected each refueling outage, the inspection method used (i.e., visual and/or ECT) for each sample, the sample size, and the applicant's basis for the inspection population and sample size.

(2) The applicant did not describe the method or technique (including codes and standards) used for the visual inspection.

(3) The applicant did not specify the acceptance requirements utilized to analyze the condition of the component based on the inspection results.

By letter dated February 20, 2003, the staff issued POI-7(d)(2), requesting the applicant to address these issues.

By letter dated March 14, 2003, the applicant responded to POI-7(d)(2) by stating that the inspection includes visible tube support structures as seen on a detailed crawlthrough of the SG secondary side. Visible tube support structures include visible portions of the vertical and diagonal supports protruding from the top of the tube bundle, the periphery of the #8 tube support plates and small portions of the periphery of the #7 eggcrate support. Also included are portions of the supports which are visible through the handholes. The results are documented in the inspection procedure and in photographs taken during the inspection with standard and macro-capable photographic equipment.

Further, the applicant explained that the method and technique were described, and there are no specific industry codes and standards available for the visual examination of these secondary side internals. Eddy-current testing of the tubes is performed per technical specifications and NEI 97-06 guidance documents.

In addition, the response stated that there is no specific industry standard for acceptance criteria established for visual inspections of the secondary side pressure boundary surfaces. The condition of the secondary side SG components is considered acceptable if the knowledgeable personnel responsible for the performance of the inspections determines that there is no evidence of damage or degradation sufficient to warrant further evaluation or performance of repair/replacement activities. The Combustion Engineering Owners Group (CEOG) Evaluation of Degraded Secondary Internals Operability Assessment, (performed as an industry response to GL 97-06), concluded that even those plants which had experienced degradation of tube supports could continue to operate safely because there was adequate margin against tube damage and the damage could be detected in the normal eddy current examinations. Therefore the detection level is not an issue. Furthermore, the CEOG evaluation concludes that this damage mechanism only occurs when there is fouling sufficient to redistribute the flow to the periphery of the bundle. No steam pressure loss has been noted at FCS which would be apparent if fouling were occurring at a level sufficient to redistribute the flow. These tube support inspections were presented in OPPD's response to GL 97-06, dated March 25, 1998. In the NRC closeout of that response, dated September 29, 1999, the staff found the inspection practices provided assurance that the SG internals are in compliance with the current licensing basis. Furthermore, since site operating experience has not found flow-accelerated corrosion in the supports, OPPD concludes that these inspections are adequate aging management.

The staff reviewed the applicant's response and finds it acceptable because it addresses the staff's issues with regard to the scope, techniques, and acceptance criteria associated with the management of the subject components with regard to loss of section thickness due to FAC. On the basis of the information provided in the POI response, the staff concludes that loss of section thickness due to FAC in tube support lattice bars made of carbon steel will be adequately managed by the SGP during the period of extended operation. POI-7(d)(2) is resolved.

The staff reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of section thickness due to FAC for tube supports (batwings, eggcrates, and vertical grids), as recommended in the GALL Report.

3.1.2.3.3.2.6 Ligament Cracking Due to Corrosion

As stated in the SRP-LR, ligament cracking due to corrosion could occur in carbon steel components in the SG tube support plate. All PWR licensees have committed voluntarily to a SG degradation management program described in NEI 97-06. The GALL Report recommends that an AMP based on the recommendations of staff-approved NEI 97-06 guidelines, or some other alternate regulatory basis for SG degradation management, be developed to ensure that this aging effect is adequately managed.

At present, the staff does not plan to endorse NEI 97-06 or detailed industry guidelines referenced therein. The staff is working with the industry to revise plant technical specifications to incorporate the essential elements of the industry's NEI 97-06 initiative as necessary to ensure tube integrity is maintained. This would require implementation of programs to ensure that performance criteria for tube structural and leakage integrity are maintained, consistent with the plant design and licensing basis. NEI 97-06 provides guidance on programmatic details for accomplishing this objective. These guidelines apply to all degradation or damage mechanisms. However, these programmatic details would be outside the scope of the technical specifications.

As part of the NRC Reactor Oversight Program, the NRC would monitor the effectiveness of these programs in terms of whether the goals of these programs are being met, particularly whether the tube structural and leakage integrity performance criteria are being maintained. The staff reviewed the applicant's proposed program to ensure that an adequate program will be in place for the management of these aging effects.

Ligament cracking due to corrosion in the carbon steel SG tube support plates is managed by the steam generator program (B.2.9) and the chemistry program (B.1.2). The staff's review of the steam generator program is discussed here. The staff's review of the chemistry program is discussed in Section 3.0.3.2 of this SER. In response to RAI B.2.9-2, the applicant indicates that tube supports (batwing, eggcrates, and vertical grids) are visually inspected for loss of material (FAC, general, pitting, crevice, and galvanic corrosion). The applicant does not describe the inspections, sample size, and acceptance criteria implemented to detect the presence of ligament cracking. By letter dated February 20, 2003, the staff issued POI-7(d)(3) requesting the applicant to provide this information.

By letter dated March 14, 2003, the applicant responded to POI-7(d)(3) by stating that cracking was inadvertently left off the list when the revised RAI response was submitted. Information regarding inspection sample size were already provided. There is no industry acceptance criteria related to detecting the presence of ligament cracking on support plates. Although minor cracking has occurred in the uppermost tube support plates, this cracking was the result of stresses being relieved after a rim cut modification to allow expansion of the plates. As stated in NUREG/CR-6754, the rim cut modification was a proactive measure to minimize the possibility of denting and delaying the onset of ligament cracking. The CEOG Evaluation of Degraded Secondary Internals Operability Assessment concluded that support plate cracking is not detrimental to the safe operation of the plant and there are no reported tube wear indications directly related to tube support degradation. Therefore, the level of detectability of cracks is not an industry issue. Furthermore, these tube support inspections were presented in OPPD's response to GL 97-06, dated March 25, 1998, and the staff found the inspection practices provided assurance that the SG internals are in compliance with the current licensing basis. Therefore, the applicant concludes that management of aging is adequate for this aging mechanism.

The staff reviewed the applicant's response to POI-7(d)(3) and finds it acceptable because the applicant provides the requested information regarding scope, techniques, acceptance criteria, and experience associated with detecting ligament cracking due to corrosion in carbon steel components in the SG tube support plate. On the basis of this POI response, the staff finds that the SGP at FCS will adequately manage ligament cracking in the tube support plate during the period of extended operation. POI-7(d)(3) is resolved.

The staff reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the ligament cracking due to corrosion for tube supports (batwings, eggcrates, and vertical grids), as recommended in the GALL Report.

3.1.2.3.3.2.7 Plant-Specific Components from Table 3.1-2 of the LRA

The applicant identified a number of plant-specific components in Table 3.1-2 of the LRA which identified the SGP as the program that manages aging of the components. The staff's evaluation of these components is documented below.

3.1.2.3.3.2.7.1 Nozzles, Nozzle Safe Ends, and Feedring

In response to RAI B.2.9-2, the applicant described the inspection program related to nozzles, nozzle safe ends, and the feedring (i.e., SG feedwater, blowdown, steam and instrument nozzles, steam and feedwater nozzle safe ends, and the SG feedring). The applicant indicated that the aging effect managed by this program for these components is loss of material due to general, pitting, and crevice corrosion. The feedring additionally has galvanic corrosion as an aging effect. Ultrasonic testing for wall thinning of the feedring in 2002 revealed little or no degradation. The external surface of the feedring is visually inspected each refueling outage for corrosion. Scope is expanded based on a discovery of an unexpected change in degradation, where change is based on review of past inspections. Since the feedring internal and external surfaces are in the same environment, the visual examination of the external surface is considered representative of the internal surface for these aging effects. The nozzles and nozzle safe ends are not inspected, but are bounded by the visual inspection of the carbon steel feedring, which is more susceptible to aging than the low-alloy steel or carbon steel nozzles and nozzle safe ends. Site Class Cleanliness Standards allow only a small amount of degradation before a condition report is required. The corrective action program provides an acceptable means of review, evaluation, and corrective action. Because the UT revealed little or no degradation in 29 years of operation, and site Class Cleanliness Standards would require corrective action long before the pressure boundary integrity of the nozzles and nozzle safe ends or flow distribution of the feedring are compromised, this visual inspection is adequate aging management.

The applicant's RAI response did not include sufficient detail for the staff to determine whether the proposed inspection will ensure that this aging effect will be adequately managed during the period of extended operation. (1) The applicant states that the nozzles and nozzle safe ends are not inspected, but are bounded by the visual inspection of the carbon steel feedring, which is more susceptible to aging than the low alloy steel or carbon steel nozzles and nozzle safe ends. The applicant must provide the basis for the statement that the carbon steel feedring is more susceptible to aging that the carbon steel nozzles and nozzle safe ends. (2) The applicant states that the external surface of the feedring is visually inspected each refueling outage for corrosion, but does not indicate the extent of the feedring that is inspected, nor the basis for this extent. (3) The visual inspection must be performed in accordance with specified requirements (e.g., ASME Code VT-1). Describe the method or technique (including codes and standards) used to perform the visual inspection. (4) The applicant needed to specify the acceptance requirements utilized to analyze the condition of the component once a condition report is initiated, which ensures that the structure and component intended function(s) are maintained under all CLB design conditions during the period of extended operation. By letter dated February 20, 2003, the staff issued POI-7(d)(4), requesting the applicant to address these issues.

By letter dated March 14, 2003, the applicant responded to POI-7(d)(4) by stating that the nozzles, nozzle safe ends and feedring are all in the same environment of deoxygenated treated water >200°F. The carbon steel feedring is more susceptible to corroding than low-alloy steel nozzles and nozzle safe ends, and therefore is bounding. The carbon steel feedring is equally susceptible to corrosion as the carbon steel nozzles and nozzle safe ends. Furthermore, the material of the feedring is thinner than the thickness of the nozzles and nozzle safe ends.

The POI response also stated that the visible portions of the feedring inspected include almost the entire feedring, excluding the underside. The basis of this extent is accessibility. In addition, POI-7(d)(1) discusses ASME Code VT-1. There are no codes and standards for performing this visual inspection. Finally, once a condition report is written, the site corrective action program provides the means of review, evaluation, and corrective action. The results of evaluations determine the acceptance criteria and may be based on many variables.

In its letter dated March 14, 2003, the applicant provided revisions to many tables in LRA Section 3. One such change resulted in crediting the steam generator integrity program for managing the aging of the steam generator blowdown nozzles. In response to Open Item 3.0-1 (line item #145) the applicant stated that the aging management of these nozzles is also bounded by the feedwater ring inspection for the same reasons described above for the other components.

The staff reviewed the applicant's response to POI-7(d)(4) and finds it acceptable because the response (1) provides the basis for using the carbon steel feedring as a bounding component for management of the nozzles and safe ends, (2) provides the extent of the feedring inspection and its basis, (3) clarifies the techniques, used for the inspections, and (4) clarifies the inspection acceptance criteria. On the basis of the information provided in the POI response, the staff finds that the SGP at FCS will adequately manage nozzles, nozzle safe ends, and the feedring during the period of extended operation. POI-7(d)(4) is resolved.

The staff reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of material due to general, pitting and crevice corrosion, and galvanic corrosion for the nozzles, nozzle safe ends, and feedring.

3.1.2.3.3.2.7.2 Secondary-Side Tubesheet

In response to RAI B.2.9-2, the applicant described the inspection program related to the secondary-side tubesheet as follows: the secondary side tubesheet is visually inspected and supplemented by tube ECT during each refueling outage for loss of material due to general, pitting, and crevice corrosion. A camera is placed on top of the tubesheet and transported along the periphery of the tube bundle and down the blowdown line. In addition, ECT of the tubes would indicate if the adjacent tubesheet was degrading. The CAP provides an acceptable means of review, evaluation, and corrective action. Because the tubesheet is over 22 inches thick and ECT can reflect tubesheet loss, this visual inspection (augmented by ECT) is adequate to maintain the pressure boundary function of the tubesheet.

The applicant's RAI response did not include sufficient detail for the staff to determine whether the proposed inspection will ensure that this aging effect will be adequately managed during the period of extended operation. The applicant did not specify the acceptance criteria (for the visual and ECT) and the basis for the acceptance criteria. By letter dated February 20, 2003, the staff issued POI-7(d)(5) requesting the applicant to address these issues.

By letter dated March 14, 2003, the applicant responded to POI-7(d)(5) by stating that there are no industry acceptance criteria for visual inspections of the tubesheet. Eddy-current testing of the tubes is performed per technical specifications and NEI 97-06 guidance documents. Based on the thickness of the tubesheet and that there is no site or industry experience related to loss of material, OPPD considers this inspection adequate management of the pressure boundary.

The staff reviewed the applicant's response to POI-7(d)(5) and finds it acceptable because it provides clarifying information with regard to the methods and acceptance criteria associated with the inspection of the SG tube sheet. On the basis of the information provided in the POI response, the staff concludes that the SGP will adequately manage the secondary side tubesheet during the period of extended operation. POI-7(d)(5) is resolved.

The staff reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of material due to general, pitting, and crevice corrosion for the secondary-side tubesheet.

3.1.2.3.3.2.7.3 Primary-Side Tubesheet and Primary Head

In response to RAI B.2.9-2, the applicant described the inspection program related to the primary-side tubesheet and primary head as follows: these components are visually inspected for cracking. Portions of the primary-side tubesheet and primary head are inspected using a remote camera each refueling outage. The tubesheet and primary head are thick, so the initiation of a crack, which could grow to be a pressure boundary threat, could easily be detected with the camera. Because the tubesheet and primary head are the same material in the same environment, and there is no operating history of cracks to these components at FCS, this visual inspection is adequate to maintain the pressure boundary function of the tubesheet and primary head.

The applicant's RAI response did not include sufficient detail for the staff to determine whether the proposed inspection will ensure that this aging effect will be adequately managed during the period of extended operation for the following three reasons:

(1) The applicant did not specify the extent (other than "portions") of the tubesheet and head that are visually inspected, or the basis for this extent.

(2) The applicant did not describe the method or technique (including codes and standards) used for the visual inspection.

(3) The applicant did not specify the acceptance requirements, and the basis for these acceptance requirements, used to analyze the condition of the component based on the inspection results.

By letter dated February 20, 2003, the staff issued POI-7(d)(6), requesting the applicant to address these issues.

By letter dated March 14, 2003, the applicant responded to POI-7(d)(6) by stating that the entire primary side tubesheet and internal head are inspected. The methods and technique were described (i.e., visual inspection by remote camera). There are no codes and standards which address this visual inspection.

There are no industry acceptance criteria regarding visual examinations of the primary head and primary side tubesheet. Since industry experience has not indicated cracking to the primary head and primary side tubesheet, and because tight primary water quality standards result in minimal corrosion levels compared to the thickness of these components, OPPD considers the visual inspection of these components as adequate management of cracking.

Overall, considering that the staff found the inspection practices presented in OPPD's response to GL 97-06 provided assurance that the condition of the SG internals are in compliance with current licensing basis for FCS, and considering that these practices continue at FCS and are conservative with regard to results of the CEOG Evaluation of Degraded Secondary Internals Operability Assessment and site and industry operating experience, OPPD considers that the management of these "added-scope" components is adequate for the period of extended operation.

The staff reviewed the applicant's response to POI-7(d)(6) and finds it acceptable because it addresses the staff's concern regarding (1) the scope of the inspections, (2) the methods and techniques, including associated codes and standards, (3) and inspection acceptance criteria associated with the management of the primary-side tubesheet and primary head. On the basis of the applicant's response, the staff concludes that the SGP will adequately manage the primary-side tubesheet and primary head during the period of extended operation. POI-7(d)(6) is resolved.

The staff reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of cracking of the primary-side tubesheet and primary head.

3.1.2.3.3.3 Conclusion

On the basis of its review of the information provided by the applicant to address the GALL recommendation, the staff finds that the SGP adequately addresses the additional issues as recommended by GALL. In addition, the staff has reviewed the clarifications and enhancements to the program and finds that the applicant's program, with the clarifications and enhancements, provides for adequate management of aging effects for which the program is credited. The staff also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Therefore, on the basis of its review, the staff concludes that the applicant has demonstrated that the SGP will effectively manage aging in the components for which this program is credited so that the intended functions of the associated components and systems 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 Alloy 600 Program

The applicant discusses its program for managing age-related degradation of the FCS Alloy 600 nozzles and their associated Alloy 82/182 weld materials in LRA Section B.3.1, "Alloy 600 Program."

3.1.2.3.4.1 Summary of Technical Information in the Application

The applicant stated that the FCS Alloy 600 program will be consistent with the requirements of GALL program XI.M11, "Nickel-Alloy Nozzles and Penetrations," as identified in the GALL Report with the following exceptions:

- XI.M11 – Exception to the program description that affects the Scope of Program and Preventative Action program attributes for the AMP. The chemistry-related portions of the program are addressed in the FCS chemistry program.

- XI.M11-4 – Exception to the Detection of Aging Effects program attribute for the AMP. The Alloy 600 Program will not rely on an enhanced leakage detection system for detection of leaks caused by PWSCC as suggested by XI.M11 in the GALL Report. Bounding evaluations exist that demonstrate that PWSCC cracks can be detected via boric acid leakage prior to the structural integrity of the pressure boundary being compromised, and prior to unacceptable material loss of carbon steel vessels due to boric acid corrosion (BAC).

The program includes participation in industry programs to determine an appropriate AMP for PWSCC of Alloy 600 and Inconel 82/182 welds. The scope of the Alloy 600 program includes the specific components identified in LRA Table 3.1-2 for which the Alloy 600 program is identified as an AMP.

3.1.2.3.4.2 Staff Evaluation

The current CLB for the applicant's Alloy 600 program, as it pertains to inspection of the ASME Class 1 nickel-based alloy components other than the vessel head penetration (VHP) nozzles, may be found in the following regulation and ASME requirements:

- 10 CFR 50.55a
- applicable requirements found in ASME Section XI, Subsections IWA and IWB, as invoked by 10 CFR 50.55a

The current CLB for the applicant's Alloy 600 program, as it pertains to inspection of the ASME Class 1 FCS VHP nozzles, may be found in the following regulation, Order, and generic communications:

- 10 CFR 50.55a
- NRC Order EA-03-009, dated February 11, 2003.
- NRC Generic Letter (GL) 97-01, dated April 1, 1997
- NRC Bulletin 2001-01, dated August 3, 2001
- NRC Bulletin 2002-01, dated March 18, 2002
- NRC Bulletin 2002-02, dated August 9, 2002

The issuance of NRC Bulletin 2001-01 is significant because it documents the first reported occurrence of circumferential cracking in the VHP nozzles of a PWR in the United States (i.e., at Oconee, Unit 3), and the safety significance related to this orientation of cracking. The NRC's issuance of Bulletins 2002-01 and 2002-02 is significant because the bulletins document how the borated reactor coolant leakage from a VHP nozzle at Davis Besse was significant enough to create a large cavity in the reactor vessel head due to corrosion of the low-alloy steel used to fabricate the reactor vessel head. Each of these bulletins raised issues regarding the ability of current ASME Section XI inspection requirements for PWR VHP nozzles and reactor vessel heads to ensure the structural integrity of the nozzles and heads during plant operation.

By Order EA-03-009, dated February 11, 2003,[1] the staff issued a generic order to modify the operating licenses of all operating PWRs in the United States and to require specific inspections of the VHP nozzles and reactor vessel head of each plant. In the correspondence letter for the Order, the staff stated its need to "establish a clear regulatory framework" for the evaluation and inspection of PWR VHP nozzles until the time when an acceptable augmented regulatory basis for inspection of the VHP nozzles could be incorporated into a revision of 10 CFR 50.55a, "Codes and Standards." The augmented inspection requirements of Order EA-03-009 supplement the applicable inspection method requirements for VHP nozzles found in Subsections IWA and IWB of Section XI to the ASME Boiler and Pressure Vessel Code and will remain in place until acceptable augmented inspection requirements for the nozzles are incorporated into a revision of 10 CFR 50.55a. Order EA-03-009 and the augmented inspection requirements contained in the Order may be accessed at the World Wide Web address given in Footnote 1 or at NRC public reading rooms.

The applicant considers the Alloy 600 program to be consistent with the program attributes of GALL program XI.M11, with the exceptions listed in Section 3.1.2.3.4.1 above. In the first of these exceptions, the applicant stated that the chemistry-related portions of the program are addressed in the FCS chemistry program. This was an exception to the Scope and Preventative Actions program attributes for the Alloy 600 program. This exception implies that the applicant considers that implementation of the chemistry program, as related to controlling the ingress of ionic impurities and dissolved oxygen into the RCS coolant, can prevent or mitigate degradation in the FCS Alloy 600 components and their associated Alloy 182/82 weld materials. The staff has two issues with this exception. The first issue is that the applicant's chemistry program (LRA Section B.1.2) does not provide any indication that the AMP, as implemented consistent with GALL program XI.M2, "Water Chemistry," contains the chemistry-related portions of the Alloy 600 Program. Since this has been identified as an exception to the Scope program attribute for the Alloy 600 program, the staff issued POI-7(e) by letter dated February 20, 2003, requesting the applicant to amend the description of the chemistry program, as provided in Section B.1.2 of Appendix B to the FCS LRA, to state that the scope of the program includes the chemistry-related portions of the FCS Alloy 600 program. By letter dated March 14, 2003, the applicant responded to POI-7(e) by revising the first sentence of LRA Section B.1.2 to read "The FCS Chemistry Program is consistent with XI.M2, 'Water Chemistry', and contains the chemistry related portions of AMP B.3.1, 'Alloy 600 Program.' OPPD is, therefore, consistent with the GALL Report relative to Alloy 600 program chemistry criteria." The staff has reviewed the applicant's response to POI-7(e) and concludes that the applicant's response to POI-7(e) is acceptable because the response corrects and clarifies that FCS AMP B.1.2, "Chemistry Program," contains the water chemistry criteria for the FCS Class 1 nickel-based alloy components. POI-7(e) is resolved.

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1 Letter EA-03-009 from S. J. Collins to Holders of Operating Licenses for Pressurized Water Reactors, "Issuance of Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," February 11, 2003. The correspondence letter, along with the augmented requirements in the attached Order, may be accessed on the World Wide Web at the following Web address:

http://www.nrc.gov/reactors/operating/ops-experience/vessel-head-degradation/vessel-head-degradation-files/order-rpv-inspections.pdf

The second issue with this exception is technical. Although EPRI Report TR-105714, Revision 3, provides guidelines for mitigating PWSCC in nickel-based alloy components, industry experience[2] indicates PWSCC can occur in the Alloy 182/82 welds associated with welded Class 1 Alloy 600 components, even when the ingress of ionic impurities and dissolved oxygen in the reactor coolant has been controlled to concentrations recommended in acceptable industry chemistry guidelines (e.g., EPRI PWR Water Chemistry Guidelines of EPRI Report TR-105714, Revision 3). The staff therefore cannot agree that implementation of the water chemistry program will be capable of preventing the occurrence of PWSCC in the FCS Class 1 Alloy 600 components and their associated Alloy 182/82 weld materials even if the ingress of impurities is controlled to acceptable concentrations. The staff's evaluation of how this issue will impact the applicant's program attributes and implementation of Alloy 600 program is discussed below.

The applicant's second exception to the Alloy 600 program deals with the Detection of Aging Effects program attribute for the AMP. In this exception, the applicant stated that it would not rely on an enhanced leakage detection system for detection of leaks caused by PWSCC, as suggested by GALL program XI.M11. According to the applicant, there are some bounding evaluations in the industry that support the conclusion that PWSCC-induced cracks can be detected via boric acid leakage prior to the structural integrity of the reactor coolant pressure boundary (RCPB) being compromised, and prior to unacceptable material loss of carbon steel vessels due to BAC. The staff does not accept this conclusion because there have been significant age-related degradation events such as those described below that invalidate it.

- The VHP nozzle cracking and leakage events at Oconee Units 1, 2, and 3; Arkansas Nuclear One Unit 1; and Davis Besse (collectively summarized in NRC Bulletins 2001-01, 2002-01, and 2002-02) demonstrate that the RCPB integrity can be violated prior to the performance of a visual examination of the reactor vessel head and in spite of the implementation of adequate RCS coolant chemistry programs.

- The Davis Besse boric acid wastage event of March 2002 (summarized in NRC Bulletins 2002-01 and 2002-02) demonstrates that severe boric acid wastage of PWR reactor vessel heads can occur in spite of the implementation of plant-specific boric acid wastage programs.

The FCS application was submitted prior to issuance of NRC Bulletins 2002-01 and 2002-02. However, the information in the applicant's LRA and the applicant's responses to NRC GL 97-01, and NRC Bulletins 2001-01, 2002-01, and 2002-02 indicates that the applicant is an active participant in the NEI program for monitoring and controlling PWSCC in VHP nozzles. The current program, as described and updated in the applicant's responses to Bulletins 2001-01, 2002-01, and 2002-02, indicate that the applicant has responded to the issues and action requests raised in the bulletins.

During its initial review of the Alloy 600 program, the staff was aware that the issue of PWSCC-induced degradation of Class 1 nickel-based alloy components may not be resolved prior to

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2 Such events are summarized in NRC Bulletins 2001-01, 2002-01, and 2002-02 for PWSCC occurring in the VHP nozzles in PWRs, and in INs 2000-17 and 2000-17, Supplement 1, for PWSCC occurring in the reactor vessel hot-leg nozzle safe-end weld of the V.C. Summer nuclear plant.

issuance of the renewed operating license for FCS and, therefore, the inspection methods proposed for the FCS Alloy 600 program in the LRA may not be acceptable during the period of extended operation for FCS. Therefore, the staff requested from the applicant a commitment to implement any actions, as part of the Alloy 600 program, that are agreed upon between the NRC and the nuclear power industry for the inspection, detection, evaluation (including the establishment of acceptance criteria for the VHP nozzle inspection techniques), and resolution of cracking that may occur in the VHP nozzles of PWRs in the United States, and specifically as the actions relate to the structural integrity of VHP nozzles in the FCS upper reactor vessel head during the period of extended operation. This request was designated as RAI B.3.1-1, Part 1, and issued by letter dated October 11, 2002.

By letter dated December 19, 2002, the applicant provided the following response to RAI B.3.1-1, Part 1:

> The FCS Alloy 600 Program currently includes a requirement to monitor industry operating experience and implement program enhancements as necessary. This issue of cracking of Alloy 600 and Alloy 82/182 material is being addressed as a current licensing basis issue.

The applicant's response to RAI B.3.1-1, Part 1, did not provide the type of commitment the staff was requesting to resolve the issues related to the Davis Besse operating experience addressed in NRC Bulletins 2002-01 and 2002-02. The staff's review of the applicant's Alloy 600 program, as well as the applicant's responses to NRC Bulletins 2001-01 and 2002-02, indicate that OPPD is relying highly on its BAC prevention program as the basis for managing PWSCC in the FCS VHP nozzles. Although the staff does concur that the issue of PWSCC in the VHP nozzles of domestic PWRs is a current licensing term issue that is outside of the scope of license renewal pursuant to 10 CFR 54.30, the program attributes for the Alloy 600 program, as they pertain to the evaluation and inspection of the FCS VHP nozzles and reactor vessel head, are not in compliance with the interim augmented evaluation and inspection requirements in NRC Order EA-03-009, dated February 11, 2003. By letter dated February 20, 2003, the staff issued POI-7(f) requesting the applicant to resolve this issue. By letter dated March 14, 2003, the applicant responded to POI-7(f), stating that it is committed to incorporating industry recommendations or mandates as applicable. Specifically, the applicant commits to implement those recommended inspection methods, inspection frequencies, and acceptance criteria resulting from industry initiatives (by the CEOG or the Material Reliability Program Integrated Task Group on nickel-based alloys) that are acceptable to the NRC for managing SCC (including PWSCC) in Class 1 nickel-based alloy components (including Class 1 components fabricated from Alloy 600 base metals and Alloy 182/82 filler materials). The applicant will implement any additional requirements that may result from the staff's resolution of the industry's responses to NRC bulletins or from orders on nickel-based alloy Class 1 components.

The staff reviewed the applicants response to POI-7(f). The staff concludes that the applicant's response to POI-7(f) is acceptable because the applicant will implement any new requirements on Class 1 nickel-based alloy components and because the applicant is committed to implementing any recommended industry initiatives on Class 1 nickel-based alloy components that may be developed in the future and that are found acceptable by the NRC. The applicant's commitment is documented in Appendix A to this SER. POI-7(f) is resolved.

NRC Bulletins 2001-01, 2002-01, and 2002-02 are specific to cracking that has occurred in the reactor vessel heads of domestic PWRs, and do not address the issue of PWSCC that may occur in other Class 1 base metal or weld components fabricated from nickel-based alloys. Therefore, the staff requested additional information regarding how the applicant is addressing the potential for the Alloy 600 and Alloy 82/182 locations in the FCS pressurizer, SGs, and RCS hot-leg piping to develop PWSCC, and what steps the applicant will take to ensure the integrity of these components during the period of extended operation. This request was designated as RAI B.3.1-1, Part 2.

RAI B.3.1-1, Part 2, was requested to resolve a question on how the Alloy 600 program was addressing cracking experience that could occur in Class 1 nickel-based alloy locations other than the FCS VHP nozzles. In relation to the Operating Experience program attribute in GALL program X1M.11, PWSCC has been reported in Alloy 182/82 J-groove welds that are used to join Alloy 600 small-bore nozzles to CE-designed pressurizers, SGs, and/or hot legs.[3] During V.C. Summer refueling outage 12 (October 2000), a through-wall crack was identified in the reactor vessel hot leg piping weld. NRC INs 2000-17 and 2000-17, Supplement 1, dated October 18, 2000, and November 16, 2000, respectively, provide details of the V.C. Summer reactor vessel hot-leg nozzle weld cracking event.

By letter dated December 19, 2002, the applicant provided its response to RAI B.3.1-1, Part 2. In its response, the applicant clarified which Class 1 components were welded with Alloy 182/82 filler metals, discussed its technical basis for concluding that the V.C. Summer cracking issue was not germane to the corresponding reactor vessel hot-leg nozzle safe-end weld at FCS, and reaffirmed that the applicant was a participant in the industry's initiatives on nickel-based alloy components.

The applicant's response to RAI B.3.1-1, Part 2, provides the locations of the remaining Alloy 600 components in the Class 1 portions of the RCS. With regard to the PWSCC-related operating experience that was detected in the reactor vessel hot-leg safe-end nozzle weld of the V.C. Summer plant, the applicant's response to RAI B.3.1-1, Part 2, also provided an assessment of why the applicant does not consider PWSCC to be an issue for the corresponding Alloy 182/82 safe-end welds at FCS. Based on the significant amount of industry experience to date, the staff considers all Class 1 Alloy 600 components and Alloy 182/82 filler materials to be susceptible to PWSCC. The applicant's response to RAI B.3.1-1, Part 2, indicated that the applicant would closely monitor the industry's initiatives and studies on cracking of Alloy 600 and Alloy 182/82 materials, and that the applicant would evaluate the need to implement any recommendations for inspection methods, inspection frequencies, and acceptance criteria that result from these initiatives. However, the response to the RAI did not provide any indication that the applicant is committed to implementing any recommended inspection methods, inspection frequencies, and acceptance criteria that will result from the

3 These occurrences have been reported as part of relief requests for implementing mechanical nozzle seal assembly repairs or half nozzle replacements for leaking Alloy 600 nozzles to Alloy 600 nozzles of CE-designed pressurizers, steam generators, or hot-leg piping, or through docketed correspondence to the NRC Document Control Desk. Licensees that have reported leakage in the Alloy 600 nozzles of CE-designed facilities have included Southern California Edison (the licensee for San Onofre), Entergy Operations, Inc. (the licensee for Waterford and ANO-2), Omaha Public Power District (the applicant for FCS), Arizona Public Service (the licensee for Palo Verde), and Florida Power and Light (the licensee for St. Lucie).

industry's initiatives. By letter dated February 20, 2003, the staff issued POI-7(f) requesting the applicant to resolve this issue.

By letter dated March 14, 2003, the applicant responded to POI-7(f), stating that it is committed to incorporating industry recommendations or mandates as applicable. Specifically, the applicant plans to implement recommended inspection methods, inspection frequencies, and acceptance criteria resulting from industry initiatives (by the CEOG or the MRP Integrated Task Group on nickel-based alloys) that are acceptable to NRC for managing SCC (including PWSCC) in Class 1 nickel-based alloy components (including Class 1 components fabricated from Alloy 600 base metals and Alloy 182/82 filler materials). The applicant also will implement any additional requirements that may result from the staff's resolution of the industry's responses to NRC bulletins and orders. The staff reviewed the applicant's response to POI-7(f) and finds the response acceptable. The applicant's commitment is documented in Appendix A to this SER. POI-7(f) is resolved.

3.1.2.3.4.3   USAR Supplement

The applicant's USAR Supplement for the Alloy 600 program is documented in Section A.2.1 of Appendix A to the LRA and provides an overview of the program as described in Section B.3.1 of Appendix B to the LRA. The CLB description for the Alloy 600 program, as reflected in Section A.2.1 of the USAR Supplement, is only reflective of the applicant's responses to GL 97-01, and not NRC Order EA-03-009 (February 11, 2003), as well as the applicant's responses to NRC Bulletin 2001-01, 2002-01, and 2002-02. In RAI B.3.1-1, Part 3, the staff requested that OPPD incorporate its responses to RAI B.3.1-1, Parts 1 and 2 into the next revision to the USAR Supplement description for the Alloy 600 program because the staff anticipated that the responses to the RAIs would provide clarifying content as to how the AMP would be sufficient to manage cracking in ASME Code Class 1 components made from Alloy 600 or Alloy 182/82 materials (i.e., Inconel alloy materials).

By letter dated December 19, 2002, the applicant provided the following response to RAI B.3.1-1, Part 3:

> The level of detail provided in response to Part 2 of this RAI is not consistent with the level of detail provided in the FCS USAR and will not be included in the USAR Supplements. OPPD will incorporate appropriate information from the OPPD responses to GL 97-01 and NRC Bulletins 2001-01, 2002-01, and 2002-02.

The staff's acceptance of the FCS Alloy 600 program is dependent upon a satisfactory description of the Alloy 600 program, that reflects final industry recommendations. Because the current USAR Supplement does not describe the applicant's final program that reflects its commitment to implement the recommendations resulting from industry initiatives, the staff has documented in Appendix A of this SER, the applicant's commitment to submit the AMPs and associated USAR Supplements, prior to the period of extended operation.

3.1.2.3.4.4   Conclusion

On the basis of its review of the applicant's program, the information provided in the applicant's responses to NRC Bulletins 2001-01, 2002-01, and 2002-02, and the commitments discussed above, the staff finds that those portions of the program for which the applicant claims consistency with GALL will be consistent with GALL. In addition, the staff has reviewed the exceptions to the GALL program and finds that the applicant's program will provide adequate management of the aging effects for which the program is credited. The staff also reviewed the USAR Supplement for this AMP and finds that, pending implementation of the applicant's commitments discussed above, the USAR Supplement will provide an adequate summary description of the program to satisfy 10 CFR 54.21(d).

Therefore, on the basis of its review, the staff concludes that, pending satisfactory implementation of the commitments discussed above, the applicant has demonstrated that the Alloy 600 program will effectively manage aging in the components for which this program is credited so that the intended functions of the associated components and systems will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3.5 Thermal Embrittlement of Cast Austenitic Stainless Steel Program

3.1.2.3.5.1 Summary of Technical Information in the Application

The applicant's thermal embrittlement of cast austenitic stainless steel (CASS) program is discussed in LRA Section B.3.7, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel." The applicant states that the program is consistent with GALL program XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)," as identified in the GALL Report. This AMP is credited with managing crack initiation and growth due to SCC and loss of fracture toughness due to thermal aging embrittlement in CASS piping.

3.1.2.3.5.2 Staff Evaluation

In LRA Section B.3.7, the applicant described its AMP to manage aging in CASS piping. The LRA stated that this AMP is consistent with GALL AMP XI.M12 with no deviations. The staff confirmed the applicant's claim of consistency during the AMR inspection. The staff also reviewed the USAR Supplement to determine whether it provides an adequate description of the program.

The applicant's operating experience shows no age-related degradation associated with thermal embrittlement of CASS.

The applicant provided its USAR Supplement for the thermal embrittlement of CASS program in Section A.2.24 of the LRA. The staff reviewed the USAR Supplement and finds that the summary description contains a sufficient level of information to satisfy 10 CFR 54.21(d).

3.1.2.3.5.3 Conclusion

On the basis of its review and inspection of the applicant's program, the staff finds that those portions of the program for which the applicant claims consistency with GALL are consistent with GALL. The staff also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program to satisfy 10 CFR 54.21(d).

Therefore, on the basis of its review, the staff concludes that the applicant has demonstrated that the thermal aging embrittlement of CASS program will effectively manage aging in the

structures and components for which this program is credited so that the intended functions of the associated components and systems will be maintained consistent with the CLB for the period of extended operation, as required by
10 CFR 54.21(a)(3).

3.1.2.4 Aging Management Review of Plant-Specific Reactor System Components

The following subsections provide the results of the staff's evaluation of the adequacy of aging management for components in each of the reactor systems and an evaluation of components that are not in GALL.

3.1.2.4.1 Reactor Vessel Internals

3.1.2.4.1.1 Summary of Technical Information in the Application

The description of the reactor vessel internals can be found in Section 2.3.1.1 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.1.1-1. The components, aging effects, and AMPs are provided in LRA Tables 3.1-1, 3.1-2, and 3.1-3.

Aging Effects

The LRA identified the following applicable aging effects for the reactor vessel internals:

- change in dimension due to void swelling
- loss of fracture toughness due to thermal and neutron embrittlement
- cracking
- loss of preload
- fatigue

Aging Management Programs

The LRA credited the following AMPs with managing the identified aging effects for the reactor vessel internals:

- Chemistry Program (B.1.2)
- Inservice Inspection Program (B.1.6)
- Fatigue Monitoring Program (B.2.4)
- Reactor Vessel Internals Inspection Program (B.2.8)
- Alloy 600 Program (B.3.1)

A description of these AMPs is provided in Appendix B of the LRA.

The applicant identified fatigue as a TLAA in Section 3.1.1 of the LRA that is applicable to reactor vessel internals. This TLAA is described in Section 4.3 of the LRA and is discussed in Section 4.3 of this SER.

3.1.2.4.1.2 Staff Evaluation

This section provides the results of the staff's evaluation of the applicant's AMR for the aging effects, and the AMPs credited for managing the aging effects, in reactor vessel internals. The staff also reviewed the applicable USAR Supplements for the AMPs to ensure that the program descriptions adequately describe the AMPs.

Aging Effects

In accordance with Section 3.1 of the LRA, the applicant has performed a review of industry experience and NRC generic communications relative to the reactor vessel internals components to ensure that the AERMs for a specific material-environment combination are the only aging effects of concern for FCS.

The LRA identified the following applicable aging effects for the reactor vessel internals:

- change in dimension due to void swelling
- loss of fracture toughness due to thermal and neutron embrittlement
- cracking
- loss of preload
- fatigue

The passive, long-lived components in the reactor vessel internals that are subject to an AMR are identified in LRA Tables 3.1-1, 3.1-2, and 3.1-3. LRA Table 3.1-1 includes components which were evaluated in the GALL Report. Components that the applicant indicates are consistent with GALL need no additional evaluation because GALL components and programs that are identified in GALL and require no further evaluation, are acceptable to the staff. Components that require further evaluation are discussed in SER Section 3.1.2.2. The materials and environments for these components are identified in GALL.

LRA Table 3.1-2 includes components which were not evaluated in GALL. The table identifies the aging effects, materials, environments, and programs proposed for managing the aging effects. The staff has reviewed the information in this table and finds that the applicant has identified the applicable aging effects.

LRA Table 3.1-3 includes components which were not evaluated in GALL, but that the applicant has determined that the component material, environment, and aging effects can be adequately managed using AMPs evaluated in the GALL Report. The staff has reviewed this table and concludes that the applicant has identified the applicable aging effects.

On the basis of its review, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with reactor vessel internals.

Aging Management Programs

The applicant has credited the following AMPs to manage the aging effects described above for the reactor vessel internals.

- Chemistry Program - SER Section 3.0.3.2
- Inservice Inspection Program - SER Section 3.0.3.5
- Fatigue Monitoring Program - SER Section 3.0.3.8
- Reactor Vessel Internals Inspection Program - SER Section 3.1.2.3.2
- Alloy 600 Program - SER Section 3.1.2.3.4

As discussed above, components that the applicant indicates are consistent with GALL need no additional evaluation because GALL components and programs that are identified in GALL and require no further evaluation, are acceptable to the staff.

LRA Table 3.1-2 includes components which were not evaluated in GALL. The table identifies the aging effects, materials, environments, and programs proposed for managing the aging effect. The staff has reviewed the information in this table and finds that the applicant has identified appropriate AMPs to manage the aging effects identified in LRA Table 3.1-2.

LRA Table 3.1-3 includes components which were not evaluated in GALL, but that the applicant has determined that the component material, environment, and aging effects can be adequately managed using AMPs evaluated in the GALL Report. The staff has reviewed this table and concludes that the applicant has identified appropriate AMPs to manage aging effects identified in LRA Table 3.1-3.

LRA Table 3.1-3, row 03, "Bolt-Thermal Shield," credits the ISI program for managing loss of preload in the thermal shield bolts. As stated in the justification column of 3.1.3.03, the basis for crediting ISI is that the material, environment, and aging effects are the same as for components evaluated in Volume 2, IV.B3.4-h, of the GALL Report. This section of the GALL Report states that GALL programs XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and XI.M14, "Loose Part Monitoring," are credited with managing aging in the components similar to the thermal shield bolts. On page B-3 of the LRA, the applicant states that a loose parts monitoring program is not credited for license renewal at FCS. Instead, the RVII program (B.2.8) is credited with managing aging. In RAI 3.1.3-1, the staff requested the applicant to identify plant-specific experience with respect to cracking and loss of preload of thermal shield bolting.

In response to RAI 3.1.3-1, the applicant committed to continue its augmented inspection of the thermal shield bolting or pins within the RVII program. The thermal shield monitoring program generated data from 1988 through 1990 that indicated the early stages of loosening of the thermal sleeve positioning pins. During the 1992 refueling outage, visual inspection of the support lugs and the positioning pins was performed. An analysis of the preload of 11 of the 16 lower positioning pins was also performed. Based on the measurements and an analytical evaluation of preload, seven lower and four upper pins were replaced. This action reduced vibrations back to normal levels.

No abnormal vibration has been detected since 1992, and the applicant continues to monitor thermal shield vibrations as a task within the RVII program. Based on the success of the thermal shield monitoring program in detecting loss of preload, and the commitment to incorporate this program in the RVII program, the staff agrees that a loose parts monitoring for thermal shield bolting is not necessary and the RVII program will be adequate for detecting aging effects for the thermal shield bolting or pins. The USAR Supplement for the RVII program (A2.2.20) did not identify that the thermal shield monitoring program is included within the RVII program and the applicant's commitment to continue this program through the license renewal period. By letter dated February 20, 2003, the staff issued POI-8(c) requesting the applicant to revise the USAR Supplement to identify that the thermal shield monitoring program is included in the RVII program. By letter dated March 14, the applicant revised the USAR Supplement to clarify that periodic monitoring of vessel internals vibration is included in the RVII program. This resolves POI-8(c).

LRA Table 3.1-2, rows 3.1.2.08 and 3.1.2.11, indicate that void swelling and reduction in fracture toughness of the reactor vessel internals flow skirt are managed by the RVII program; row 3.1.2.09 indicates that cracking of the reactor vessel internals flow skirt is managed by the Alloy 600 program. In response to RAI 3.1.2-3, the applicant indicates that the way in which the flow skirt is to be managed under the Alloy 600 program is yet to be determined; however, that determination will be made before entry into the period of extended operation. On the basis of the applicant's commitment to provide a program for managing the aging effects associated with the reactor vessel internals flow skirt before entry into the period of extended operation, the staff considers this issue resolved.

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with reactor vessel internals. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable.

3.1.2.4.1.3 Conclusions

On the basis of its review, the staff concludes that, pending satisfactory implementation of the commitment discussed above, the applicant has adequately identified the aging effects, and the AMPs credited for managing the aging effects, for the reactor vessel internals such that the component 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 USAR Supplement program description and concludes that it provides an adequate program description of the AMPs credited for managing aging in the reactor vessel internals, as required by 10 CFR 54.21(d).

3.1.2.4.2 Reactor Coolant System

3.1.2.4.2.1 Summary of Technical Information in the Application

The description of the RCS can be found in Section 2.3.1.2 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.1.2-1. The components, aging effects, and AMPs are provided in LRA Tables 3.1-1, 3.1-2, and 3.1-3.

Aging Effects

The LRA identified the following applicable aging effects for the RCS:

- loss of material
- loss of fracture toughness due to thermal embrittlement
- cracking

- loss of preload
- fatigue

Aging Management Programs

The LRA credited the following AMPs with managing the identified aging effects for the RCS:

- Bolting Integrity Program (B.1.1)
- Chemistry Program (B.1.2)
- Flow-Accelerated Corrosion Program (B.1.5)
- Inservice Inspection Program (B.1.6)
- Boric Acid Corrosion Prevention Program (B.2.1)
- Cooling Water Corrosion Program (B.2.3)
- Steam Generator Program (B.2.9)
- Alloy 600 Program (B.3.1)
- General Corrosion of External Surfaces Program (B.3.3)
- One-Time Inspection Program (B.3.5)
- Thermal Aging Embrittlement of Cast Austenitic Stainless Steel Program (B.3.7)

A description of these AMPs is provided in Appendix B of the LRA.

The applicant identified fatigue as a TLAA in Section 3.1.1 of the LRA that is applicable to the RCS. This TLAA is described in Section 4.3 of the LRA and is discussed in Section 4.3 of this SER.

3.1.2.4.2.2 Staff Evaluation

This section provides the results of the staff's evaluation of the applicant's AMR for the aging effects and the AMPs credited for managing them, in the RCS. The staff also reviewed the applicable USAR Supplements to ensure that the program descriptions adequately describe the AMPs.

Aging Effects

In accordance with Section 3.1 of the LRA, the applicant has performed a review of industry experience and NRC generic communications relative to the RCS components to ensure that the AERMs for a specific material-environment combination are the only aging effects of concern for FCS.

The LRA identified the following applicable aging effects for the RCS:

- loss of material
- loss of fracture toughness due to thermal embrittlement
- cracking
- loss of preload
- fatigue

The passive, long-lived components in the RCS that are subject to an AMR are identified in LRA Tables 3.1-1, 3.1-2, and 3.1-3. LRA Table 3.1-1 includes components which were evaluated in the GALL Report. Components that the applicant indicates are consistent with GALL need no additional evaluation because GALL components and programs that are identified in GALL, and require no further evaluation, are acceptable to the staff. Components that require further evaluation are discussed in SER Section 3.1.2.2. The materials and environment for these components are identified in GALL.

LRA Table 3.1-2 includes components which were not evaluated in GALL. The table identifies the aging effects, materials, environments, and programs proposed for managing the aging effect. The staff has reviewed the information in this table and finds that the applicant has identified the applicable aging effects.

LRA Table 3.1-3 includes components which were not evaluated in GALL, but that the applicant has determined that the component materials, environments, and aging effects can be adequately managed using AMPs evaluated in the GALL Report. The staff has reviewed this table and concludes that the applicant has identified the applicable aging effects.

On the basis of its review, the staff finds the applicant has identified the appropriate aging effects for the materials and environments associated with the RCS.

Aging Management Programs

The applicant has credited the following AMPs to manage the aging effects described above for the RCS:

- Bolting Integrity Program - SER Section 3.0.3.1
- Chemistry Program - SER Section 3.0.3.2
- Flow-Accelerated Corrosion Program - SER Section 3.0.3.4
- Inservice Inspection Program - SER Section 3.0.3.5
- Boric Acid Corrosion Prevention Program - SER Section 3.0.3.6
- Cooling Water Corrosion Program - SER Section 3.0.3.7
- General Corrosion of External Surfaces Program - SER Section 3.0.3.12
- One-Time Inspection Program - SER Section 3.0.3.13
- Steam Generator Program - SER Section 3.1.2.3.3
- Alloy 600 Program - SER Section 3.1.2.3.4
- Thermal Aging Embrittlement of Cast Austenitic Stainless Steel Program - SER Section 3.1.2.3.5

LRA Table 3.1-2 includes components which were not evaluated in GALL. The table identifies the aging effects, materials, environments, and programs proposed for managing the aging effects. The staff has reviewed the information in this table and finds that the applicant has identified appropriate AMPs to manage the aging effects identified in LRA Table 3.1-2.

LRA Table 3.1-2, rows 3.1.2.04 and 3.1.2.05, indicate that the SG lower head, manway cladding, primary side tubesheet, and reactor coolant pump (RCP) thermal barrier are subject to cracking and the AMP is the chemistry program. The chemistry program will, to some extent, mitigate cracking but will not monitor cracking. In RAI 3.1.2-1, the staff requested that the applicant provide its basis for concluding that monitoring of crack initiation and growth is not necessary for these components. The applicant's program for managing the aging effects for the SG lower head, manway cladding, and primary side tubesheet is discussed in SER Section 3.1.2.3.3.

In response to RAI 3.1.2-1, the applicant indicated that the RCP thermal barriers are not accessible for routine maintenance or inspection. During the 2001 refueling outage, the "A" RCP rotating assembly was replaced with a new rotating assembly and the existing assembly was sent to a vendor for refurbishment. As part of the refurbishment, the thermal barrier on the "A" RCP was visually inspected and a dye-penetrant examination was performed. No indications of cracks were identified. A visual inspection was performed on the "C" RCP after it was removed for refurbishment during the 2002 refueling outage. No indication of degradation was identified. The applicant indicates that it will continue to visually inspect and perform a dye-penetrant exam on the two remaining RCP thermal barriers when the rotating assemblies are refurbished. This was confirmed in the response to POI-8(d), which was issued by the staff on February 20, 2003. Based on the operating and inspection results to date on the RCP thermal barriers, the applicant does not believe that periodic ISI of the RCP thermal barriers is necessary. However, the applicant has agreed to include the RCP thermal barriers within its one-time inspection program. Since cracking has not been observed in all the inspections performed to date, the staff agrees that periodic ISI of the RCP thermal barriers is not necessary and that the one-time inspection program will be an acceptable program to determine whether this cracking is a significant aging effect for the RCP thermal barriers. In addition to the RCP thermal barriers, the applicant will also credit the one-time inspection program for the inspection of the seal water coolers, which are part of the RCP rotating assembly. This one-time inspection will perform an air drop test on the seal water coolers to ensure tube integrity.

Components in LRA Table 3.1-2, Item 3.1.2.02 (pressurizer heater sleeves, etc.) are subject to loss of material due to crevice corrosion. These components are made from nickel-based alloys, including Alloy 600, in a borated treated water environment. This aging effect is managed by the chemistry program. The chemistry program will, to some extent, mitigate crevice corrosion but will not monitor it. To monitor whether crevice corrosion is occurring in the components listed in Item 3.1.2.02, the staff issued RAI 3.1.2-5 by letter dated October 11, 2002, requesting the applicant to identify an inspection program for these components that will monitor whether crevice corrosion is occurring.

In response to RAI 3.1.2-5, the applicant indicated that they conservatively included loss of material as an aging effect for Alloy 600 in borated treated water. This aging effect is not identified in the GALL Report for this same material and environment. To validate the effectiveness of the chemistry program, the applicant proposes to determine the worst-case location for the potential occurrence of this aging effect and perform a one-time inspection of this location prior to the period of extended operation.

GALL AMP XI.M32 indicates the one-time inspection is to be utilized when an aging effect is not expected to occur, but insufficient data exist to completely rule it out, or when an aging effect is expected to progress very slowly. The one-time inspection provides additional assurance that aging is either not occurring or the evidence of aging is so insignificant that aging management is not warranted. In order to determine whether loss of material resulting from crevice corrosion in the presence of sufficient levels of oxygen, halogens, sulfates, or copper is not expected to occur, the applicant must review its inspection records to determine whether this aging effect has previously occurred at FCS for the components listed in Item 3.1.2.02. If it has not occurred, the proposed program is acceptable. If a component has experienced this aging effect in the past, the applicant should identify when it occurred, the corrective action, and the reason for not expecting it to occur in the future. If this aging effect is expected to occur in the future, periodic examination is necessary. By letter dated March 14, 2003, as part of its response to POI-8(d), the applicant indicated that there has been no operating experience at FCS relative to crevice corrosion of nickel-based alloys. It is generally considered not to be a credible aging mechanism for these alloys.

Since loss of material resulting from crevice corrosion is not expected to occur and there has not been any evidence of this aging effect at FCS, a one-time inspection program for components in LRA Table Item 3.1.2.02 is acceptable. This resolves this portion of POI-8(d). Additional discussion of programs for nickel-based alloys can be found in Section 3.1.2.3.4.2 of this SER.

LRA Table 3.1-2, row 3.1.2.16, indicates cracking of pressurizer instrument nozzle inserts are managed by the chemistry and the ISI programs. This aging effect for the pressurizer instrument nozzle inserts is also addressed in LRA Table 3.1-1, row 3.1.1.11. This item indicates that the aging effect will be managed by the Alloy 600 program. In response to RAI 3.1.2-4, the applicant indicates that the details of this program are still in development, but will be completed prior to the period of extended operation. On the basis of the applicant's commitment to provide a program for managing the aging effects associated with the pressurizer instrument nozzle inserts before entry into the period of extended operation, the staff considers this issue resolved.

LRA Table 3.1-3 includes components which were not evaluated in GALL, but that the applicant has determined that the component material, environment, and aging effects can be adequately managed using AMPs evaluated in the GALL Report. The staff has reviewed this table and concludes that the applicant has identified appropriate AMPs to manage the aging effects identified in LRA Table 3.1-3.

On the basis of its review, the staff finds that the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with the RCS. In addition, the staff reviewed the associated program descriptions in the USAR Supplement and found them acceptable.

3.1.2.4.2.3 Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and the AMPs credited for managing the aging effects, for the RCS such that the component 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 USAR Supplement program descriptions and concludes that they provide an adequate program description of the AMPs credited for managing aging in the RCS, as required by 10 CFR 54.21(d)

3.1.2.4.3 Reactor Vessel

3.1.2.4.3.1 Summary of Technical Information in the Application

The description of the reactor vessel can be found in Section 2.3.1.3 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.1.3-1. The components, aging effects, and AMPs are provided in LRA Tables 3.1-1, 3.1-2, and 3.1-3.

Aging Effects

The LRA identified the following applicable aging effects for the reactor vessel:

- loss of fracture toughness due to neutron irradiation embrittlement
- cracking
- loss of preload
- fatigue
- loss of material

Aging Management Programs

The LRA credited the following AMPs with managing the identified aging effects for the reactor vessel:

- Bolting Integrity Program (B.1.1)
- Chemistry Program (B.1.2)
- Inservice Inspection Program (B.1.6)
- Reactor Vessel Integrity Program (B.1.7)
- Boric Acid Corrosion Prevention Program (B.2.1)
- Alloy 600 Program (B.3.1)
- One-Time Inspection Program (B.3.5)

A description of these AMPs is provided in Appendix B of the LRA.

The applicant identified fatigue and neutron irradiation embrittlement as TLAAs in Section 3.1.1 of the LRA that are applicable to the reactor vessel. The fatigue TLAA is described in Section 4.3 of the LRA and is discussed in Section 4.3 of this SER. The neutron irradiation embrittlement TLAA is described in Section 4.2 of the LRA and is discussed in Section 4.2 of this SER.

3.1.2.4.3.2 Staff Evaluation

This section provides the results of the staff's evaluation of the applicant's AMR for the aging effects, and the AMPs credited for managing the aging effects, in the reactor vessel. The staff also reviewed the applicable USAR Supplements for the AMPs to ensure that the program descriptions adequately describe the AMPs.

Aging Effects

The applicant has performed a review of industry experience and NRC generic communications relative to the reactor vessel components to provide assurance that the AERMs for a specific material-environment combination are the only aging effects of concern for FCS.

The LRA identified the following applicable aging effects for the reactor vessel:

- loss of fracture toughness due to neutron irradiation embrittlement
- cracking
- loss of preload
- fatigue
- loss of material

The passive, long-lived components in the reactor vessel that are subject to an AMR are identified in LRA Tables 3.1-1, 3.1-2, and 3.1-3. LRA Table 3.1-1 includes components which were evaluated in the GALL Report. Components that the applicant indicates are consistent with GALL need no additional evaluation because GALL components and programs that are identified in GALL, and require no further evaluation, are acceptable to the staff. Components that require further evaluation are discussed in SER Section 3.1.2.2. The materials and environment for these components are identified in GALL.

LRA Table 3.1-2 includes components which were not evaluated in GALL. The table identifies the aging effects, materials, environments, and programs proposed for managing the aging effects. The staff has reviewed the information in this table and finds that the applicant has identified the applicable aging effects.

LRA Table 3.1-3 includes components which were not evaluated in GALL, but that the applicant has determined that the component materials, environments, and aging effects can be adequately managed using AMPs evaluated in the GALL Report. The staff has reviewed this table and concludes that the applicant has identified the applicable aging effects.

On the basis of its review, the staff finds the applicant has identified the appropriate aging effects for the materials and environments associated with the reactor vessel.

Aging Management Programs

The applicant has credited the following AMPs to manage the aging effects described above for the reactor vessel:

- Bolting Integrity Program - SER Section 3.0.3.1
- Chemistry Program - SER Section 3.0.3.2
- Inservice Inspection Program - SER Section 3.0.3.5
- Boric Acid Corrosion Prevention Program - SER Section 3.0.3.6
- One-Time Inspection Program - SER Section 3.0.3.13
- Reactor Vessel Integrity Program - SER Section 3.1.2.3.1
- Alloy 600 Program - SER Section 3.1.2.3.4

LRA Table 3.1-2 includes components which were not evaluated in GALL. The table identifies the aging effects, materials, environments, and programs proposed for managing them. The staff has reviewed the information in this table and finds that the applicant has identified appropriate AMPs to manage the aging effects identified in LRA Table 3.1-2.

LRA Table 3.1-3 includes components which were not evaluated in GALL, but that the applicant has determined that the component materials, environments, and aging effects can be adequately managed using AMPs evaluated in the GALL Report. The staff has reviewed this table and concludes that the applicant has identified appropriate AMPs to manage aging effects identified in LRA Table 3.1-3.

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with the reactor vessel. In addition, the staff reviewed the associated program descriptions in the USAR Supplement and found them acceptable.

3.1.2.4.3.3 Conclusion

On the basis of its review, the staff concludes that the applicant has identified the aging effects, and the AMPs credited for managing the aging effects, for the reactor vessel, such that the component 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 USAR Supplement program descriptions and concludes that they provide an adequate program description of the AMPs credited for managing aging in the reactor vessel, as required by 10 CFR 54.21(d).

3.1.3 Evaluation Findings

The staff has reviewed the information in Section 3.1 of the LRA. On the basis of its review, the staff concludes that, pending satisfactory implementation of the commitments discussed above, the applicant has demonstrated that the aging effects associated with the components of the reactor systems will be adequately managed so that these components will perform their intended functions in accordance with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3). In addition, the staff also concludes that, pending satisfactory implementation of the commitments discussed above, the USAR Supplements for FCS provide an acceptable description of the programs and activities for managing the effects of aging of the components of the reactor systems for the period of extended operation, as required by 10 CFR 54.21(d).

3.2 Engineered Safety Features Systems

This section addresses the aging management of the components of the engineered safety fatures (ESF) systems group. The systems that make up the ESF systems group are described in the following SER Sections:

- Safety Injection and Containment Spray (2.3.2.1)
- Containment Penetration and System Interface Components for Non-CQE Systems (2.3.2.2)

As discussed in Section 3.0.1 of this SER, the components in each of these ESF systems are included in one of three LRA tables. LRA Table 3.2-1 consists of ESF system components that are evaluated in the GALL Report, LRA Table 3.2-2 consists of ESF system components that are not evaluated in the GALL Report, and LRA Table 3.2-3 consists of ESF system components that are not evaluated in the GALL Report, but that the applicant has determined can be managed using a GALL AMR and associated AMP.

3.2.1 Summary of Technical Information in the Application

In LRA Section 3.2, the applicant described its AMRs for the ESF systems group at FCS. The description of the systems that comprise the ESF systems group can be found in LRA Section 2.3.2. The passive, long-lived components in these systems that are subject to an AMR are identified in LRA Tables 2.3.2.1-1 and 2.3.2.2-1. The applicant's AMRs include an evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify aging effects that require management. These reviews concluded that the aging effects requiring management based on FCS operating experience were consistent with the aging effects identified in the GALL Report. The applicant's review of industry operating experience included a review of operating experience through 2001. The results of this review concluded that aging effects requiring management based on industry operating experience were consistent with aging effects identified in the GALL Report. The applicant's ongoing review of plant-specific and industry operating experience is conducted in accordance with the FCS operating experience program.

3.2.2 Staff Evaluation

In Section 3.2 of the LRA, the applicant described its AMR for the ESF systems. The staff reviewed LRA Section 3.2 to determine whether the applicant has provided sufficient information to demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB throughout the period of extended operation, in accordance with the requirements of 10 CFR 54.21(a)(3), for the ESF system components that are determined to be within the scope of license renewal and subject to an AMR.

The applicant referenced the GALL Report in its AMR. The staff has previously evaluated the adequacy of the aging management of ESF system components for license renewal as documented in the GALL Report. Thus, the staff did not repeat its review of the matters described in the GALL Report, except to ensure that the material presented in the LRA was applicable, and to verify that the applicant had identified the appropriate programs as described and evaluated in the GALL Report. The staff evaluated those aging management issues recommended for further evaluation in the GALL Report. The staff also reviewed aging management information submitted by the applicant that was different from that in the GALL Report or was not addressed in the GALL Report. Finally, the staff reviewed the USAR Supplement to ensure that it provided an adequate description of the programs credited with managing aging for the ESF system components.

Table 3.2-1 below provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.2 that are addressed in the GALL Report.

Table 3.2-1

Staff Evaluation for FCS Engineered Safety Features System Components in the GALL Report

Component Group	Aging Effect/Mechansim	AMP in GALL Report	AMP in LRA	Staff Evaluation
Piping, fittings, and valves in emergency core cooling system	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	TLAA	Consistent with GALL. GALL recommends further evaluation (See Section 3.2.2.2.1 below)
Piping, fittings, pumps, and valves in emergency core cooling system	Loss of material due to general corrosion	Water chemistry and one-time inspection	N/A	BWR
Components in containment spray (PWR only), standby gas treatment (BWR only), containment isolation, and emergency core cooling systems	Loss of material due to general corrosion	Plant-specific	Chemistry Program One-Time Inspection Program	Consistent with GALL. GALL recommends further evaluation (See Section 3.2.2.2.2 below)
Piping, fittings, pumps, and valves in emergency core cooling system	Loss of material due to pitting and crevice corrosion	Water chemistry and one-time inspection	N/A	BWR
Components in containment spray (PWR only), standby gas treatment (BWR only), containment isolation, and emergency core cooling systems	Loss of material due to pitting and crevice corrosion	Plant-specific	Chemistry program One-time inspection program	Consistent with GALL. GALL recommends further evaluation (See Section 3.2.2.2.3 below)
Containment isolation valves and associated piping	Loss of material due to microbiologically influenced corrosion	Plant-specific	None	Not applicable to FCS. FCS containment isolation valves and associated piping are not exposed to environments susceptible to MIC (See 3.2.2.2.4 below)
Seals in standby gas treatment system	Changes in properties due to elastomer degradation	Plant-specific	N/A	BWR
High pressure safety injection (charging) pump miniflow orifice	Loss of material due to erosion	Plant-specific	None	Not applicable to FCS (See 3.2.2.2.5 below)
External surface of carbon steel components	Loss of material due to general corrosion	Plant-specific	General corrosion of external surfaces program	Consistent with GALL. GALL recommends further evaluation (see Section 3.2.2.2.6 below)

Drywell and suppression chamber spray system nozzles and flow orifices	Plugging of nozzles and flow orifices due to general corrosion	Plant-specific	N/A	BWR
Piping and fittings of CASS in emergency core cooling system	Loss of fracture toughness due to thermal aging embrittlement	Thermal aging embrittlement CASS	None	Not applicable to FCS. CASS piping and fittings are not used in the ESF systems at FCS
Components serviced by open-cycle cooling system	Local loss of material due to corrosion and/or buildup of deposit due to biofouling	Open-cycle cooling water system	None	Not applicable. The FCS ESF components are not serviced by open-cycle cooling system
Components serviced by closed-cycle cooling system	Loss of material due to general, pitting, and crevice corrosion	Closed-cycle cooling water system	Closed-cycle cooling water system	Consistent with GALL (See Section 3.2.2.1 below)
Emergency core cooling system valves and lines to and from HPCI qnd RCIC pump turbines	Wall thinning due to flow-accelerated corrosion	Flow-accelerated corrosion	N/A	BWR
Pumps, valves, piping, and fittings in containment spray and emergency core cooling systems	Crack initiation and growth due to SCC	Water chemistry	Water chemistry	Consistent with GALL (See Section 3.2.2.1 below)
Pumps, valves, piping, and fittings in emergency core cooling systems	Crack initiation and growth due SCC and IGSCC	Water chemistry and BWR stress corrosion cracking	N/A	BWR
Carbon steel components	Loss of material due to boric acid corrosion	Boric acid corrosion	Boric acid corrosion	Consistent with GALL (See Section 3.2.2.1 below)
Closure bolting in high pressure or high temperature systems	Loss of material due to general corrosion, loss of preload due to stress relaxation, and crack initiation and growth due to cyclic loading or SCC	Bolting integrity	Bolting integrity	Consistent with GALL (See Section 3.2.2.1 below)

The staff's review of the ESF systems for the FCS LRA is contained within four sections of this SER. Section 3.2.2.1 is the staff review of components in the ESF systems that the applicant indicates are consistent with GALL and do not require further evaluation. Section 3.2.2.2 is the staff review of components in the ESF systems that the applicant indicates are consistent with GALL and for which GALL recommends further evaluation. Section 3.2.2.3 is the staff evaluation of AMPs that are specific to the ESF systems. Section 3.2.2.4 contains an evaluation of the adequacy of aging management for components in each system in the ESF systems group, and includes an evaluation of components in the ESF systems that the applicant indicates are not in GALL. This section is divided into two subsections, safety injection and containment spray (SI&CS) and containment penetrations and system interface components for non-CQE systems, which are the two systems that the applicant has identified as within the ESF systems group.

3.2.2.1 Aging Management Evaluations in the GALL Report That Are Relied on for License Renewal, Which Do Not Require Further Evaluation

For component groups evaluated in GALL for which the applicant has claimed consistency with GALL, and for which GALL does not recommend further evaluation, the staff sampled components in these groups during its inspection and audit conducted from January 6-10, 2003, and from January 20-23, 2003, to determine whether the plant-specific components contained in these GALL component groups were bounded by the GALL evaluation. The staff also sampled component groups during its inspection and audit to determine whether the applicant had properly identified those component groups in GALL that were not applicable to its plant. Specifically, the staff sampled the following three audit items for the ESF systems:

1. In LRA Tables 2.3.2.1-1 and 2.3.2.2-1, closure boltings of the ESF systems are linked to rows 3.2.1.11 and 3.2.1.12 of LRA Table 3.2-1. The audit was to confirm that, for all in-scope closure bolting in the ESF systems, the bolt materials are consistent with those specified in the GALL Report, Vol. 2.

2. In LRA Table 3.2-1, row 3.2.1.08, the applicant stated that the ESF components in FCS are not serviced by an open-cycle cooling system. The audit was to confirm that there are no heat exchangers in the ESF systems that will be serviced by the open-cycle cooling water system program of the GALL Report, Vol. 2.

3. In LRA Table 2.3.2.1-1, the heat exchanger is shown to be linked to LRA Table 3.2-1, row 3.2.1.09. The audit was to confirm that the heat exchanger materials and environments are consistent with those specified in the GALL Report, Vol. 2.

Based on the information provided by the applicant, the audit confirmed in Item 1 that the safety injection and containment spray systems have carbon steel, stainless steel, and low-alloy steel bolting and that containment penetrations and system interfaces have carbon steel and low-alloy steel bolting. This is consistent with GALL and is therefore acceptable. The audit also confirmed in Item 3 that the heat exchanger components in the safety injection and containment spray systems, which are managed by AMR Item 3.2.1.09, are stainless steel, carbon steel, and cast iron, and are exposed to corrosion-inhibited treated water. This is consistent with GALL and is therefore acceptable. For audit Item 2, based on the information provided by the applicant, the audit revealed that no ESF heat exchangers are normally serviced by raw water. However, there are several ESF heat exchangers for which raw water would be utilized should component cooling water (CCW) not be available in an emergency situation. These are the shutdown cooling heat exchangers, the high/low pressure safety injection pump bearing oil and seal coolers, and the containment spray pump bearing oil and seal coolers. Although raw water will be utilized only in emergency situations, the staff considered that the worst-case scenario should be accounted for in the AMR for the above ESF heat exchangers. By letter dated February 20, 2003, the staff issued POI-9(a) requesting the applicant to identify the AERMs for the above heat exchangers when exposed to a raw water environment, as well as the associated AMP. By letter dated March 14, 2003, the applicant responded to POI-9(a) by stating that the normal operating condition of the ESF heat exchangers is with the CCW as the medium, not the raw water (RW) system. The RW system is only credited for operation should there be a failure of the CCW system. According to the Statements of Consideration (SOC) for the Rule, “Consideration of ancillary functions would expand the scope of the license renewal review beyond the Commission’s intent [III.c(ii)].” The applicant considers the operation of the

RW system upon the failure of the CCW to be an ancillary (auxiliary) function, and not an intended function. Therefore, the raw water environment need not be considered for these heat exchangers for the period of extended operation.

The staff reviewed the applicant's response and finds it acceptable because, as stated in the SOC for the Rule, the RW system performs an ancillary function with regard to the CCW system. The details of the staff's AMR inspection and audit can be found in AMR Inspection Report 50-285/03-07 dated March 20, 2003 and audit report dated April 9, 2003. POI-9(a) is resolved.

The staff reviewed the USAR Supplements for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for the ESF system components for which the applicant claimed consistency with GALL to satisfy 10 CFR 54.21(d).

On the basis of its review of the inspection and audit results, the staff finds that the applicant's claim of consistency with the GALL Report is acceptable, and that it is acceptable for the applicant to reference the information in the GALL Report for ESF system components. Therefore, on this basis, the staff concludes that the components for which the applicant claimed consistency with GALL will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2 Aging Management Evaluations in the GALL Report That Are Relied on for License Renewal, For Which GALL Recommends Further Evaluation

For component groups evaluated in GALL for which the applicant has claimed consistency with GALL, and for which GALL recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues for which GALL recommended further evaluation. In addition, the staff sampled components in these groups during the AMR inspection to determine whether the plant-specific components contained in these GALL component groups were bounded by the GALL evaluation. The results of the staff's AMR inspection can be found in Inspection Report 50-285/03-07, dated March 20, 2003.

The GALL Report indicates that further evaluation should be performed for the aging effects described in the following sections.

3.2.2.2.1 Cumulative Fatigue Damage

The GALL report identifies fatigue as a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The staff reviewed the evaluation of this TLAA in Section 4.3 of this SER, following the guidance in Section 4.3 of the SRP-LR.

For the safety injection and containment spray system, the applicant identified that time-limiting aging analyses are applicable to the flow element/orifice, heat exchanger, pipes & fittings, and valve bodies. The applicant discusses the TLAA in Section 4.3.1 of the LRA, "Reactor Coolant and Associated System Fatigue." This TLAA is evaluated in Section 4.3 of this SER.

The staff reviewed the applicant' s USAR Supplement and concluded that it provides an adequate description of the TLAA credited with managing this aging effect, as required by 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of cumulative fatigue damage for components in the applicable FCS ESF system, as recommended in the GALL report.

3.2.2.2.2 Loss of Material Due to General Corrosion

As stated in the SRP-LR, loss of material due to general corrosion could occur in the containment spray system header and spray nozzle components, and the external surfaces of PWR carbon steel components. The GALL Report recommends further evaluation on a plant-specific basis to ensure that loss of material is adequately managed for these components. The staff reviewed the applicant's proposed programs to ensure that an adequate program will be in place for the management of loss of material in these components.

The applicant indicated in LRA Table 3.2-1, row 3.2.1.02, that the applicable FCS components, materials, and environments identified in GALL are covered in LRA row 3.2.1.06. The LRA noted that, although this item is addressed in the GALL Report, it is not identified in the SRP-LR. In Volume 2 of the GALL Report, this is addressed under the component type, "External Surface of Carbon Steel Components." This component grouping is evaluated in Section 3.2.2.2.6 of this SER.

For the internal surfaces of pipes, fittings, and valve bodies in the containment penetrations and system interfaces, LRA Table 2.3.2.2-1 provides a link to LRA Table 3.4-1, row 3.4.2.02. Here, loss of material due to general (as well as pitting and crevice) corrosion, in steam or treated water environments, was identified as an aging effect to be managed by the chemistry and one-time inspection programs. The staff review of these two AMPs is found in Sections 3.0.3.2 and 3.0.3.13, respectively, of this SER.

The staff reviewed the USAR Supplement for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for the ESF system components for which the applicant claimed consistency with GALL, as required by 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of material due to general corrosion for components in the ESF systems, as recommended in the GALL Report.

3.2.2.2.3 Local Loss of Material Due to Pitting and Crevice Corrosion

As stated in the SRP-LR, local loss of material from pitting and crevice corrosion could occur in containment spray components, containment isolation valves and associated piping, and buried portions of the refueling water tank external surface. The GALL Report recommends further evaluation to ensure that loss of material is adequately managed for these components. The staff reviewed the applicant's proposed programs to ensure that an adequate program will be in place for the management of local loss of material due to pitting and crevice corrosion of these components.

In LRA Table 3.2-1, row 3.2.1.03, the applicant credited its chemistry program, supplemented by the one-time inspection program, for managing the loss of material due to pitting and crevice corrosion. The applicant stated that the effectiveness of the chemistry program will be verified with an inspection of stagnant flow locations within the subject systems. These inspections will be conducted in accordance with the one-time inspection program.

The staff reviewed the applicant's proposed programs to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation. The staff verified that the applicant's one-time inspection of selected components is performed at susceptible locations, based on severity of conditions, time of service, and the lowest design margin. The staff also verified that the proposed inspection would be performed using techniques similar to ASME Code and ASTM standards, including visual, ultrasonic, and surface techniques.

The staff reviewed the USAR Supplements for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for the ESF system components for which the applicant claimed consistency with GALL, as required by 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of material due to pitting and crevice corrosion for components in the ESF systems, as recommended in the GALL Report.

3.2.2.2.4 Local Loss of Material Due to Microbiologically Influenced Corrosion

As stated in the SRP-LR, local loss of material due to MIC could occur in PWR containment isolation valves and associated piping in systems that are not addressed in other chapters of the GALL Report. The GALL Report recommends further evaluation to ensure that local loss of material is adequately managed for these components. The staff reviewed the applicant's proposed programs to ensure that an adequate program will be in place for the management of local loss of material due to MIC of the containment isolation barriers.

In LRA Table 3.2-1, row 3.2.1.04, under the "Discussion" column, the applicant stated "No FCS containment isolation valves (CIVs) and associated piping, in systems that are not addressed in this or other sections of this application were determined to be subject to the aging effect of loss of material due to microbiologically influenced corrosion (MIC)." In RAI 3.2.1-1, the staff requested the applicant to clarify this statement, and clarify whether the CIVs and the associated piping at FCS are managed in accordance with the GALL Report. By letter dated December 19, 2002, the applicant stated that the only systems associated with containment penetrations, for which the discussion column of the LRA is applicable, are the demineralized water system, instrument air system, and SG blowdown system. The applicant clarified by stating that the above statement should read, "No FCS containment isolation valves and associated piping in systems that are addressed in this or other sections of this application were determined to be subject to the aging effect of loss of material due to microbiologically influenced corrosion (MIC)."

In addition to this clarification, in a meeting on November 21, 2002, the staff requested the applicant to provide documented evidence of the material/environment combinations for the components related to the containment penetrations and system interfaces, and to provide justification that MIC is not an aging effect requiring management for these components. In its letter of December 19, 2002, the applicant did not provide the requested information, except to state that the operating experience at FCS is such that MIC has not been experienced in any of these FCS systems. The staff considered the response to be insufficient because the requested information regarding the material/environment combinations was not provided. By letter dated February 20, 2003, the staff issued POI-9(b), requesting the above information. By letter dated March 14, 2003, the applicant provided the requested information. Specifically, visual inspections that discover corrosion cannot identify the mechanism that is causing the corrosion. Further evaluation is required. If MIC ever were to occur, it would be discovered by the credited activities that monitor the loss of material. A condition report would be generated, as part of the CAP, to report the corrosion. An evaluation of the corrosion would be performed to determine its cause. If the mechanism was determined to be MIC, appropriate corrective actions would be taken and activities implemented to mitigate and monitor the mechanism. However, as was stated in response to RAI 3.2.1-1, MIC has never been observed in any ESF systems, and for this reason, MIC is not considered a plausible aging mechanism. The staff reviewed the applicant’s response to POI-9(b) and finds it acceptable because it provides more detail regarding how MIC would be detected and addressed if it were to occur. POI-9(b) is resolved.

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of material due to MIC for components in the ESF systems, as recommended in the GALL Report. In addition, the staff concludes that the applicant’s USAR Supplement provides an adequate summary description of the programs and activities credited for managing the effects of aging for the ESF system components for which the applicant claimed consistency with GALL, as required by 10 CFR 54.21(d).

3.2.2.2.5 Local Loss of Material Due to Erosion

As stated in the SRP-LR, local loss of material due to erosion could occur in the high pressure safety injection pump miniflow orifice. This aging mechanism and effect will apply only to pumps that are normally used as charging pumps in the chemical and volume control system. The GALL Report recommends further evaluation to ensure that local loss of material is adequately managed for these components. The staff reviewed the applicant’s proposed programs to ensure that an adequate program will be in place to manage this aging effect.

The applicant stated in LRA Table 3.2-1, row 3.2.1.05, that the high pressure safety injection (charging) pump miniflow orifice, as identified in GALL, is not applicable to FCS. Since this GALL component grouping does not exist at FCS, loss of material due to erosion is not a relevant AERM. Therefore, no AMP is required.

3.2.2.2.6 Loss of Material Due to General Corrosion

As stated in the SRP-LR, loss of material due to general corrosion could occur in the external surfaces of carbon steel pipes and fittings, primary containment penetrations, and valve bodies of the containment penetrations and system interfaces. This component type is only found in Table 2 of GALL, Volume 1. It is not found in Table 3.2-1 of the SRP. The GALL Report recommends further evaluation on a plant-specific basis to ensure that loss of material is adequately managed for these components. The staff reviewed the applicant’s proposed programs to ensure that an adequate program will be in place for the management of general corrosion of these components.

The applicant credited the general corrosion of external surfaces program for managing the aging effect of loss of material due to general corrosion for the above carbon steel components. The staff's evaluation of this AMP is documented in Section 3.0.3.12 of this SER.

The staff reviewed the applicant's general corrosion of external surfaces program to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation. The staff verified that the applicant's AMPs are sufficient to manage the identified aging effect of loss of material.

The staff reviewed the USAR Supplement for the AMP and concludes that it provides an adequate summary description of the programs and activities credited for managing the effects of aging for the ESF system components for which the applicant claimed consistency with GALL, as required by 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of material due to general corrosion for components in the ESF systems, as recommended in the GALL Report.

3.2.2.2.7 Conclusions

The staff has reviewed the applicant's evaluation of the issues for which GALL recommends further evaluation for components in the ESF systems. On the basis of this finding, and the finding that the remainder of the applicant's program is consistent with GALL, the staff concludes that these aging effects will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the USAR Supplements for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for the ESF system components for which the applicant claimed consistency with GALL, as required by 10 CFR 54.21(d).

3.2.2.3 Aging Management Programs for ESF System Components

In SER Section 3.2.2.1, the staff evaluated the applicant's conformance with the aging management recommended by GALL for ESF systems. In SER Section 3.2.2.2, the staff reviewed the applicant's evaluation of the issues for which GALL recommends further evaluation. In this SER section, the staff presents its evaluation of the programs used by the applicant to manage the aging of the components within the ESF systems.

The applicant credits nine AMPs to manage the aging effects associated with components in the ESF systems. All nine AMPs are credited with managing aging for components in other system groups (common AMPs). The staff's evaluation of the common AMPs that are credited with managing aging in ESF system components is provided in Section 3.0.3 of this SER. The common AMPs are listed below and have been found acceptable for managing aging in ESF components:

- Bolting Integrity Program - SER Section 3.0.3.1
- Chemistry Program - SER Section 3.0.3.2
- Flow Accelerated Corrosion Program - SER Section 3.0.3.4
- Boric Acid Corrosion Prevention Program - SER Section 3.0.3.6
- Cooling Water Corrosion Program - SER Section 3.0.3.7
- Periodic Surveillance and Preventive Maintenance Program - SER Section 3.0.3.10
- General Corrosion of External Surfaces Program - SER Section 3.0.3.12
- One-Time Inspection Program - SER Section 3.0.3.13
- Selective Leaching Program - SER Section 3.0.3.14

3.2.2.4 Aging Management Review of Plant-Specific ESF System Components

In this section of the SER, the staff presents its review of the applicant's AMR for specific components within the ESF systems. To perform its evaluation, the staff reviewed the components listed in LRA Tables 2.3.2.1 and 2.3.2.2 to determine whether the applicant properly identified the applicable aging effects and the AMPs needed to adequately manage these aging effects. This portion of the staff's review involved identification of the aging effects for each ESF component, ensuring that each aging effect was evaluated in the appropriate LRA AMR table in Section 3, and that management of the aging effect was captured in the appropriate AMP. The results of the staff's review are provided in the following sections.

3.2.2.4.1 <u>Safety Injection and Containment Spray</u>

3.2.2.4.1.1 Summary of Technical Information in the Application

The AMR results for the SI&CS are presented in Tables 3.2-1, 3.2-2, and 3.2-3 of the LRA. The applicant used the GALL Report format to present its AMRs for SI&CS components in LRA Table 3.2-1. In LRA Tables 3.2-2 and 3.2-3, the applicant identified the component group designation along with its (1) material, (2) environment, (3) aging effect(s), and (4) aging management program(s).

The description of the SI&CS system can be found in Section 2.3.2.1 of this SER. The safety injection system injects borated water into the RCS to provide emergency core cooling following a loss-of-coolant accident. The function of the containment spray system is to limit the containment structure pressure rise by providing a means for cooling the containment atmosphere after the occurrence of a loss-of-coolant accident. The passive, long-lived components in these two systems that are subject to an AMR are identified in LRA Table 2.3.2.1-1.

Aging Effects

Table 2.3.2.1-1 of the LRA lists the following SI&CS system components:

- leakage accumulators
- bolting, filter/strainers
- flow element/orifice
- heat exchanger
- orifice plate
- pipes and fittings

- pump casings
- injection tanks, and tubing
- valve bodies.

Stainless steel components in these two systems are identified as being subject to loss of material due to pitting and crevice corrosion from exposure to an oxygenated treated water environment. Stainless steel materials are identified as being susceptible to crack initiation and growth due to SCC caused by exposure to chemically treated borated water environments. No aging effects were identified for the external surfaces of stainless steel and brass/bronze components exposed to ambient air.

Carbon and low-alloy steel closure bolting is identified as being subject to loss of material due to general corrosion, loss of preload due to stress relaxation, and crack initiation and growth due to cyclic loading or SCC resulting from exposure to air, moisture, humidity, and leaking fluid environments. Carbon and low-alloy steel components are identified as being subject to loss of material due to corrosion from exposure to borated water leaks. No aging effects were identified for the external surface of carbon steel components exposed to dry air/gas environments.

Cast iron materials are identified as being subject to loss of material due to selective leaching from exposure to corrosion-inhibited treated water environments.

Galvanized steel materials are identified as being subject to loss of material due to general or crevice corrosion from exposure to containment air environments.

Stainless steel, carbon steel, and cast iron components in corrosion-inhibited treated water are identified as being subject to loss of material due to general, pitting, and crevice corrosion. Crack initiation and growth due to SCC of carbon steel with stainless steel cladding may result from exposure to chemically treated borated water environments.

Alloy 600 materials are identified as being susceptible to loss of material due to crevice corrosion and cracking due to SCC in treated water environments, Alloy 600 materials may also be susceptible to loss of material due to crevice corrosion and MIC in corrosion-inhibited treated water environments, given the presence of sufficient levels of oxygen, halogens, and sulfates.

Brass material may be susceptible to cracking due to SCC from exposure to a corrosion-inhibited treated water environment because of the ammonium compounds present in the water due to the nitrite corrosion inhibitor. Brass and copper are also identified as being susceptible to loss of material due to crevice and pitting corrosion, galvanic corrosion, and MIC in corrosion-inhibited treated water environments.

Aging Management Programs

The following AMPs are utilized to manage aging effects in the SI&CS system:

- Bolting Integrity Program (B.1.1)
- Chemistry Program (B.1.2)
- Boric Acid Corrosion Prevention Program (B.2.1)
- Cooling Water Corrosion Program (B.2.2)

- Periodic Surveillance and Preventive Maintenance Program (B.2.7)
- Selective Leaching Program (B.3.6)

A description of these AMPs is provided in Appendix B of the LRA.

3.2.2.4.1.2 Staff Evaluation

Aging Effects

The staff reviewed the information in LRA Tables 2.3.2.1-1, 3.2-1, 3.2-2, and 3.2-3 for the SI&CS system. During its evaluation, the staff determined that additional information was needed to complete its review.

In LRA Table 3.2-1, row 3.2.1.12, the applicant stated that for closure bolting in high-pressure or high-temperature systems, the plant-specific bolting integrity program will be used to manage the aging effects of loss of material due to general corrosion, loss of preload due to stress relaxation, and crack initiation and growth due to cyclic loading or SCC. The applicant stated in LRA Appendix B that the bolting integrity program is consistent with GALL program XI.M18, "Bolting Integrity," with the exception that FCS has not identified SCC as a credible aging effect requiring management for high-strength carbon steel bolting in plant indoor air. In addition, FCS stated that it will utilize ASME Section XI, Subsection IWF, visual VT-3 inspection requirements rather than volumetric inspection for inspection of supports.

In RAI 3.2.1-2, the staff requested the applicant to provide a basis on which to conclude that SCC will not be considered as a credible AERM, and to address the adequacy of using VT-3 visual examination of Subsection IWF to detect the identified aging effects of loss of material, loss of preload, and cracking. By letter dated December 12, 2002, the applicant responded by stating that for the carbon steel bolting in question, (1) the material is not readily susceptible to SCC, (2) a caustic or mixed acid solution environment is not present, and (3) elevated temperatures are not present. The applicant, therefore, stated that SCC is not a credible AERM for the closure bolting. The applicant also stated that support bolting does not perform a pressure retention function like flange bolting, pump casing bolting, etc., therefore, a VT-3 inspection is deemed to be adequate.

On the basis of its review of the information provided in the LRA, and the additional information included in the applicant's response to the above RAI, the staff finds that the aging effects that result from contact of the SI&CS system components to the environments described in LRA Tables 2.3.2.1-1, 3.2-1, 3.2-2, and 3.2-3 are consistent with industry experience for these combinations of materials and environments. Therefore, the staff finds the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the SI&CS system.

Aging Management Programs

The applicant credited the following AMPs for managing the aging effects in the SI&CS system:

- Bolting Integrity Program - SER Section 3.0.3.1
- Chemistry Program - SER Section 3.0.3.2
- Boric Acid Corrosion Prevention Program - SER Section 3.0.3.6

- Cooling Water Corrosion Program - SER Section 3.0.3.7
- Periodic Surveillance and Preventive Maintenance Program - SER Section 3.0.3.10
- Selective Leaching Program - SER Section 3.0.3.14

The above AMPs are credited for managing the aging effects of several components in other structures and systems and are, therefore, considered common AMPs. The staff has evaluated these common AMPs and found them to be acceptable for managing the aging effects identified for this system. The staff's evaluation of these AMPs is documented in Sections 3.0.3.1, 3.0.3.2, 3.0.3.6, 3.0.3.7, 3.0.3.10, and 3.0.3.14, respectively, of this SER.

After evaluating the applicant's AMR for each of the components in the SI&CS system, the staff evaluated the AMPs listed above to determine if they are appropriate for managing the identified aging effects. For those components identified in Table 3.2-1 of the LRA, the staff verified that the applicant credited the AMP(s) recommended by the GALL Report. For the components identified in LRA Tables 3.2-2 and 3.2-3, the staff verified that the applicant credited an AMP that is appropriate for the identified aging effect(s). In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

On the basis of its review of the information provided in the LRA, the staff concludes that the above identified AMPs will effectively manage the aging effects for the components in the SI&CS system.

3.2.2.4.1.3 Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and the AMPs credited for managing the aging effects, for the SI&CS system, such that the component 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 USAR Supplement program descriptions and concludes that they provide adequate program descriptions of the AMPs credited for managing aging in the SI&CS system to satisfy 10 CFR 54.21(d).

3.2.2.4.2 <u>Containment Penetrations and System Interface Components for Non-CQE Systems</u>

3.2.2.4.2.1 Summary of Technical Information in the Application

The AMR results for the containment penetrations and system interface components for non-CQE systems are presented in Tables 3.2-1, 3.2-2, and 3.2-3 of the LRA. The applicant used the GALL Report format to present its AMR of these components in LRA Table 3.2-1. In LRA Tables 3.2-2 and 3.2-3, the applicant identified the component group designation along with its (1) material, (2) environment, (3) aging effect(s), and (4) aging management program(s).

The description of the containment penetration and system interface components for non-CQE systems can be found in Section 2.3.2.2 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.2.2-1. The components, aging effects, and AMPs are provided in LRA Tables 3.2-1, 3.2-2, and 3.2-3.

Aging Effects

Components of the containment penetration and system interface are described in LRA Section 2.3.2.2 as being within the scope of license renewal and subject to an AMR. Table 2.3.2.2-1 of the LRA lists individual components of the system including bolting, heat exchanger, pipes and fittings, primary containment penetrations, and valve bodies.

Stainless steel components are identified as being subject to loss of material due to crevice and pitting corrosion from exposure to oxygenated treated water environments and halogen and sulfates, respectively. Stainless steel components in corrosion-inhibited treated water are subject to loss of material due to general, pitting, and crevice corrosion, and cracking.

Carbon and low-alloy steel closure bolting may be subject to loss of material due to general corrosion, loss of preload due to stress relaxation, and crack initiation and growth due to cyclic loading or SCC resulting from exposure to air, moisture, humidity and leaking fluid environments. Carbon and low-alloy steel components are identified as being subject to loss of material due to corrosion from the exposure to borated water environments. Carbon steel components are identified as being subject to the aging effect of loss of material due to general, pitting, and crevice corrosion from exposure to steam or treated water environments. Carbon steel components are identified as being subject to loss of material (wall thinning) due to FAC from exposure to treated water and saturated steam.

Aging Management Programs

The following AMPs are utilized to manage aging effects in the containment penetrations and system interfaces:

- Bolting Integrity Program (B.1.1)
- Chemistry Program (B.1.2)
- Flow Accelerated Corrosion Program (B.1.5)
- Boric Acid Corrosion Prevention Program (B.2.1)
- Cooling Water Corrosion Program (B.2.2)
- Periodic Surveillance and Preventive Maintenance Program (B.2.7)
- General Corrosion of External Surfaces Program (B.3.3)
- One-Time Inspection Program (B.3.5)

A description of these AMPs is provided in Appendix B of the LRA.

3.2.2.4.2.2 Staff Evaluation

Aging Effects

The staff reviewed the information in LRA Tables 2.3.2.2-1, 3.2-1, 3.2-2, and 3.2-3 for the containment penetrations and system interfaces. During its review, the staff determined that additional information was needed to complete its review. The staff's requests for additional information are provided in RAI 3.2.1-1 for the issue of MIC as a potential aging effect, and RAI 3.2.1-2 for the issue of closure bolting. The staff's discussion of these two RAIs and their resolution by the applicant are provided in Sections 3.2.2.2.4 and 3.2.2.4.1.2 of this SER, respectively."

On the basis of its review of the information provided in the LRA, and the applicant's responses to the staff's RAIs, the staff finds that the aging effects that result from contact of containment penetrations and system interface SCCs to the environments described in LRA Tables 2.3.2.2-1, 3.2-1, 3.2-2, and 3.2-3, are consistent with industry experience for these combinations of materials and environments. Therefore, the staff finds the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the containment penetrations and system interfaces.

Aging Management Program

The applicant credited the following AMPs for managing the aging effects in the containment penetrations and system interfaces:

- Bolting Integrity Program - SER Section 3.0.3.1
- Chemistry Program - SER Section 3.0.3.2
- Flow-Accelerated Corrosion Program - SER Section 3.0.3.4
- Boric Acid Corrosion Prevention Program - SER Section 3.0.3.6
- Cooling Water Corrosion Program - SER Section 3.0.3.7
- Periodic Surveillance and Preventive Maintenance Program - SER Section 3.0.3.10
- General Corrosion of External Surfaces Program - SER Section 3.0.3.12
- One-Time Inspection Program - SER Section 3.0.3.13

The above AMPs are credited for managing the aging effects of several components in other structures and systems and are, therefore, considered common AMPs. The staff has evaluated these common AMPs and found them to be acceptable for managing the aging effects identified for this system. The staff's evaluation of these AMPs is documented in Sections 3.0.3.1, 3.0.3.2, 3.0.3.4, 3.0.3.6, 3.0.3.7, 3.0.3.10, 3.0.3.12, and 3.0.3.13, respectively, of this SER.

After evaluating the applicant's AMR for each of the components in the containment penetration and system interface components for non-CQE systems, the staff evaluated the AMPs listed above to determine if they are appropriate for managing the identified aging effects. For those components identified in Table 3.2-1 of the LRA, the staff verified that the applicant credited the AMP(s) recommended by the GALL Report. For the components identified in LRA Tables 3.2-2 and 3.2-3, the staff verified that the applicant credited an AMP that is appropriate for the identified aging effect(s). In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

On the basis of its review of the information provided in the LRA, the staff concludes that the above identified AMPs will effectively manage the aging effects for the components of the containment penetrations and system interface components system.

3.2.2.4.2.3 Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and the AMPs credited for managing the aging effects, for the containment penetrations and system interface components for non-CQE systems such that the component 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 USAR Supplement program descriptions and concludes that they provide adequate program descriptions of the AMPs credited for managing aging in the containment penetrations and system interface components for non-CQE systems to satisfy
10 CFR 54.21(d).

3.2.3 Evaluation Findings

The staff has reviewed the information in Section 3.2 of the LRA. On the basis of its review, the staff concludes that the applicant has demonstrated that the aging effects associated with the components of the ESF systems will be adequately managed so that these systems will perform their intended functions in accordance with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also concludes that the USAR Supplements contain acceptable descriptions of the programs and activities for managing the effects of aging for the ESF for the period of extended operation to satisfy 10 CFR 54.21(d).

3.3 Auxiliary Systems

This section addresses the aging management of the components of the auxiliary systems group. The systems that make up the auxiliary systems group are described in the following SER Sections:

- Chemical and Volume Control (2.3.3.1)
- Spent Fuel Pool Cooling (2.3.3.2)
- Emergency Diesel Generators (2.3.3.3)
- Diesel Generator Lube Oil and Fuel Oil (2.3.3.4)
- Auxiliary Boiler Fuel Oil and Fire Protection Fuel Oil (2.3.3.5)
- Emergency Diesel Generator Jacket Water (2.3.3.6)
- Diesel Starting Air (2.3.3.7)
- Instrument Air (2.3.3.8)
- Nitrogen Gas (2.3.3.9)
- Containment Ventilation (2.3.3.10)
- Auxiliary Building HVAC (2.3.3.11)
- Control Room HVAC and Toxic Gas Monitoring (2.3.3.12)
- Ventilating Air (2.3.3.13)
- Fire Protection (2.3.3.14)
- Raw Water (2.3.3.15)
- Component Cooling (2.3.3.16)
- Liquid Waste Disposal (2.3.3.17)
- Gaseous Waste Disposal (2.3.3.18)
- Primary Sampling (2.3.3.19)
- Radiation Monitoring - Mechanical (2.3.3.20)

As discussed in Section 3.0.1 of this SER, the components in each of these auxiliary systems are rolled up into one of three LRA tables. LRA Table 3.3-1 consists of auxiliary system components that are evaluated in the GALL Report, LRA Table 3.3-2 consists of auxiliary system components that are not evaluated in the GALL Report, and LRA Table 3.3-3 consists of auxiliary system components that are not evaluated in the GALL Report, but the applicant has determined can be managed using a GALL AMR and associated AMP.

3.3.1 Summary of Technical Information in the Application

In LRA Section 3.3, the applicant described its AMRs for the auxiliary systems group at FCS. The passive, long-lived components in these systems that are subject to an AMR are identified in LRA Tables 2.3.3.1-1 through 2.3.3.20-1.

The applicant's AMRs included an evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify aging effects that require management. These reviews concluded that the aging effects requiring management based on FCS operating experience were consistent with aging effects identified in GALL. The applicant's review of industry operating experience included a review of operating experience through 2001. The results of this review concluded that aging effects requiring management based on industry operating experience were consistent with aging effects identified in GALL. The applicant's ongoing review of plant-specific and industry operating experience is conducted in accordance with the FCS operating experience program.

3.3.2 Staff Evaluation

In Section 3.3 of the LRA, the applicant describes its AMR for the auxiliary systems at FCS. The staff reviewed LRA Section 3.3 to determine whether the applicant has provided sufficient information to demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB throughout the period of extended operation, in accordance with the requirements of 10 CFR 54.21(a)(3), for the auxiliary system components that are determined to be within the scope of license renewal and subject to an AMR.

The applicant referenced the GALL Report in its AMR. The staff has previously evaluated the adequacy of the aging management of auxiliary system components for license renewal as documented in the GALL Report. Thus, the staff did not repeat its review of the matters described in the GALL Report, except to ensure that the material presented in the LRA was applicable, and to verify that the applicant had identified the appropriate programs as described and evaluated in the GALL Report.

The staff evaluated those aging management issues recommended for further evaluation in the GALL Report. The staff also reviewed aging management information submitted by the applicant that was different from that in the GALL Report or was not addressed in the GALL Report. Finally, the staff reviewed the USAR Supplement to ensure that it provided an adequate description of the programs credited with managing aging for the auxiliary system components.

Table 3.3-1 below provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.3 that are addressed in the GALL Report.

Table 3.3-1

Staff Evaluation Table for FCS Auxiliary System Components Evaluated in the GALL Report

Component Group	Aging Effect/Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Components in spent fuel pool cooling and cleanup	Loss of material due to general, pitting, and crevice corrosion	Water chemistry and one-time inspection	Not applicable to FCS	GALL recommends further evaluation (See Section 3.3.2.2.1 below)
Linings in spent fuel pool cooling and cleanup system; seals and collars in ventilation systems	Hardening, cracking and loss of strength due to elastomer degradation; loss of material due to wear	Plant-specific	General Corrosion of External Surfaces Program, Periodic Surveillance and Preventive Maintenance Program	Consistent with GALL for ventilation systems. GALL recommends further evaluation (See Section 3.3.2.2.2 below)
Components in load handling, chemical and volume control system (PWR), and reactor water cleanup and shutdown cooling systems (older BWR)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Time-Limited Aging Analyses	Consistent with GALL. GALL recommends further evaluation (See Section 3.3.2.2.3 below)
Heat exchangers in reactor water cleanup system (BWR); high pressure pumps in chemical and volume control system (PWR)	Crack initiation and growth to SCC or cracking	Plant-specific	Chemistry Program and One-Time Inspection Program	Consistent with GALL. GALL recommends further evaluation (See Section 3.3.2.2.4 below)
Components in ventilation systems, diesel fuel oil system, and emergency diesel generator systems; external surfaces of carbon steel components	Loss of material due to general, pitting, and crevice corrosion, and MIC	Plant-specific	Periodic Surveillance and Preventive Maintenance, General Corrosion of External Surfaces_Program, and Fire Protection Program	GALL recommends further evaluation (See Section 3.3.2.2.5 below)
Components in reactor coolant pump oil collect system of fire protection	Loss of material due to galvanic, general, pitting, and crevice corrosion	One-time inspection	One-Time Inspection Program	Consistent with GALL. GALL recommends further evaluation (See Section 3.3.2.2.6 below)
Diesel fuel oil tanks in diesel fuel oil system and emergency diesel generator system	Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling	Fuel oil chemistry and one-time inspection	Diesel Fuel Monitoring and Storage Program	Consistent with GALL. GALL recommends further evaluation (See Section 3.3.2.2.7 below)
Piping, pump casing, and valve body and bonnets in shutdown cooling system (older BWR)	Loss of material due to pitting and crevice corrosion	Water chemistry and one-time inspection	not applicable	BWR

Heat exchangers in chemical and volume control system	Crack initiation and growth to SCC and cyclic loading	Water chemistry and a plant-specific verification program	Chemistry Program, Cooling Water Corrosion Program, Inservice Inspection Program	GALL recommends further evaluation (See Section 3.3.2.2.8 below)
Neutron absorbing sheets in spent fuel storage racks	Reduction of neutron absorbing capacity and loss of material due to general corrosion (Boral, boron steel)	Plant-specific	Periodic Surveillance and Preventive Maintenance Program	Consistent with GALL. GALL recommends further evaluation (See Section 3.3.2.2.9 below). These components are scoped under structures and are addressed in Section 3.5.2.4.3 of this SER.
New fuel rack assembly	Loss of material due to general, pitting, and crevice corrosion	Structures monitoring	Structures Monitoring Program	Consistent with GALL (See Section 3.5.2.1 of this SER). These components are scoped under structures and are addressed in Section 3.5.2.4.3 of this SER.
Spent fuel storage racks and valves in spent fuel pool cooling and cleanup	Crack initiation and growth due to stress corrosion cracking	Water chemistry	Chemistry Program	Consistent with GALL (See Section 3.5.2.1 of this SER). These components are scoped under structures and are addressed in Section 3.5.2.4.3 of this SER.
Neutron absorbing sheets in spent fuel storage racks	Reduction of neutron absorbing capacity due to Boraflex degradation	Boraflex monitoring	not applicable	The applicant has determined that these components are not applicable to FCS because FCS does not have Boraflex in the spent fuel storage racks.
Closure bolting and external surfaces of carbon steel and low-alloy steel components	Loss of material due to boric acid	Boric acid corrosion	Boric Acid Corrosion Program	Consistent with GALL (See Section 3.3.2.1 below)
Components in or serviced by closed-cycle cooling water system	Loss of material due to general, pitting, and MIC	Closed-cycle cooling water system	Cooling Water Corrosion Program	Consistent with GALL (See Section 3.3.2.1 below)
Cranes including bridge and trolleys and rail system in load handling systems	Loss of material due to general corrosion and wear	Overhead heavy load and light load handling systems	Overhead Load Handling Systems Inspection Program	Consistent with GALL (See Section 3.5.2.1 of this SER) . These components are scoped under structures and are addressed in Section 3.5.2.4.3 of this SER.

Components in or serviced by open-cycle cooling water systems	Loss of material due to general, pitting, crevice and galvanic corrosion, MIC, and biofouling; buildup of deposit due to biofouling	Open-cycle cooling water system	Cooling Water Corrosion Program	Consistent with GALL (See Section 3.3.2.1 below)
Buried piping and fittings	Loss of material due to general, pitting, and crevice corrosion, and MIC	Buried piping and tanks surveillance or Buried piping and tanks inspection	Buried Surfaces External Corrosion Program, Diesel Fuel Monitoring and Storage Program	GALL recommends further evaluation (See Section 3.3.2.2.10 below)
Components in compressed air system	Loss of material due to general and pitting corrosion	Compressed air monitoring	Not applicable	The environment identified in GALL is not applicable.
Components (doors and barrier penetration seals) and concrete structures in fire protection	Loss of material due to wear; hardening and shrinkage due to weathering	Fire protection	Fire Protection Program	Consistent with GALL (See Section 3.5.2.1 below)
Components in water-based fire protection	Loss of material due to general, pitting, crevice and galvanic corrosion, MIC, and biofouling	Fire water system	Fire Protection Program	Consistent with GALL (See Section 3.3.2.1 below)
Components in diesel fire system	Loss of material due to galvanic, general, pitting, and crevice corrosion	Fire protection and fuel oil chemistry	Diesel Fuel Monitoring and Storage Program	Consistent with GALL (See Section 3.3.2.1 below)
Tanks in diesel fuel oil system	Loss of material due to general, pitting, and crevice corrosion	Above-ground carbon steel tanks	not applicable	The applicant has determined that the tanks at FCS do not match the GALL for this item.
Closure bolting	Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and SCC	Bolting integrity	Bolting Integrity Program	Consistent with GALL (See Section 3.3.2.1 below)
Components in contact with sodium pentaborate solution in standby liquid control system (BWR)	Crack initiation and growth due to SCC	Water chemistry	not applicable	BWR
Components in reactor water cleanup system	Crack initiation and growth due to SCC and IGSCC	Reactor water cleanup system inspection	not applicable	BWR
Components in shutdown cooling system (older BWR)	Crack initiation and growth due to SCC	BWR stress corrosion cracking and water chemistry	not applicable	BWR

Components in shutdown cooling system (older BWR)	Loss of material due to pitting and crevice corrosion and MIC	Closed-cycle cooling water system	not applicable	BWR
Components (aluminum bronze, brass, cast iron, cast steel) in open-cycle and closed-cycle cooling water systems, and ultimate heat sink	Loss of material due to selective leaching	Selective leaching of materials	Selective Leaching Program	Consistent with GALL (See Section 3.3.2.1 below)
Fire barriers, walls, ceilings and floors in fire protection	Concrete cracking and spalling due to freeze-thaw, aggressive chemical attack, and reaction with aggregates; loss of material due to corrosion of embedded steel	Fire protection and structures monitoring	Fire Protection Program, Structures Monitoring Program	Consistent with GALL (See Section 3.5.2.1 of this SER). These components are scoped under structures and are addressed in Section 3.5.2.4.2 of this SER.

The staff's review of the auxiliary systems for the FCS LRA is contained within four sections of this SER. Section 3.3.2.1 is the staff review of components in the auxiliary systems that the applicant indicates are consistent with GALL and do not require further evaluation. Section 3.3.2.2 is the staff review of components in the auxiliary systems that the applicant indicates are consistent with GALL and GALL recommends further evaluation. Section 3.3.2.3 is the staff evaluation of AMPs that are specific to the auxiliary systems group. Section 3.3.2.4 contains an evaluation of the adequacy of aging management for components in each system in the auxiliary systems group and includes an evaluation of components in the auxiliary systems that the applicant indicates are not in GALL.

3.3.2.1 Aging Management Evaluations in the GALL Report That Are Relied on for License Renewal, Which Do Not Require Further Evaluation

For component groups evaluated in GALL for which the applicant has claimed consistency with GALL, and for which GALL does not recommend further evaluation, the staff sampled components in these groups during the AMR inspection to determine whether the plant-specific components contained in these GALL component groups were bounded by the GALL evaluation. The staff also sampled component groups during the AMR inspection to determine whether the applicant had properly identified those component groups in GALL that were not applicable to its plant. The results of the staff's AMR inspection can be found in AMR Inspection Report 50-285/03-07, dated March 20, 2003.

The staff reviewed the USAR Supplement for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for the auxiliary system components for which the applicant claimed consistency with GALL, as required by 10 CFR 54.21(d).

On the basis of its review of the inspection results, the staff finds that the applicant's claim of consistency with GALL is acceptable, and that it is acceptable for the applicant to reference the information in the GALL Report for auxiliary system components. Therefore, on this basis, the staff concludes that the applicant has demonstrated that the components for which the applicant claimed consistency with GALL will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2 Aging Management Evaluations in the GALL Report That Are Relied on for License Renewal, For Which GALL Recommends Further Evaluation

For component groups evaluated in GALL for which the applicant has claimed consistency with GALL, and for which GALL recommends further evaluation, the staff reviewed the LRA to determine whether it adequately addressed the issues for which GALL recommended further evaluation. In addition, the staff sampled components in these groups during the AMR inspection to determine whether the plant-specific components contained in these GALL component groups were bounded by the GALL evaluation. The results of the staff's AMR inspection can be found in AMR Inspection Report 50-285/03-07, dated March 20, 2003.

The GALL Report indicates that further evaluation should be performed for the aging effects described in the following sections.

3.3.2.2.1 Loss of Material Due to General, Pitting, and Crevice Corrosion

Loss of material due to general, pitting, and crevice corrosion could occur in the channel head and access cover, tubes, and tubesheets of the heat exchanger in the spent fuel pool cooling system, while loss of material due to pitting and crevice corrosion could occur in the filter housing, valve bodies, and nozzles of the ion exchanger in the spent fuel pool cooling system. The water chemistry program relies on monitoring and control of reactor water chemistry to manage the effects of loss of material from general, pitting, or crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause general, pitting, or crevice corrosion. Therefore, verification of the effectiveness of the chemistry control program should be performed to ensure that corrosion is not occurring. 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, and the SRP-LR states that a one-time inspection of select components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

The above is described in the GALL and SRP-LR background for LRA Item 3.3.1.01. The applicant has determined that the GALL AMR for the spent fuel pool cooling system, as identified in LRA Table 3.3.1-01, is not applicable to FCS.

Many of the GALL AMR items covered by Item 3.3.1.01 are elastomer-lined carbon steel components, and the applicant has stated that these items are not applicable to FCS. The staff considers this to be a plant-specific design issue and finds the applicant's conclusion acceptable. GALL/SRP item 3.3.1-01 also addresses the heat exchangers in the spent fuel pool cooling system. For the heat exchangers, the applicant has elected to use the chemistry program and the cooling water corrosion program, as indicated by the LRA Table 2.3.3.2-1 links to items 3.2.1.09 and 3.3.3.01. The inspections of the heat exchanger that are performed under the cooling water corrosion program cover both the cooling water side and the spent fuel pool side of the heat exchanger, as was verified during the staff's AMR inspection and audit conducted from January 6-10, 2003, and from January 20-23, 2003. The staff finds this acceptable. The staff's evaluation of these AMPs is documented in Sections 3.0.3.2 and 3.0.3.7 of this SER, respectively. For the piping, fittings, and other stainless steel components in the spent fuel pool cooling system exposed to borated treated water, the applicant's December 12, 2002, response to RAI 3.3-1 clarified that the aging management is through link 3.3.3-01. This link addresses SCC of stainless steel in borated treated water, and uses the chemistry program with no backup inspections based on the GALL recommendations for emergency core cooling systems (ECCS) with similar materials and environments. However, for the spent fuel pool cooling system, the GALL (link 3.3.1.01) recommends that the loss of material due to general, pitting, and crevice corrosion be managed by the chemistry program coupled with inspections to verify that aging effects are not occurring, due to the potential for impurities to reach high concentrations in areas of low flow. Therefore, by letter dated February 20, 2003, the staff issued POI-10(h), requesting the applicant to describe the inspections of the spent fuel pool system components that will be performed to verify that a loss of material is not occurring. By letter dated March 14, 2003, the applicant responded to POI-10(h), stating that none of the items in Section VII.A3 of the GALL Report apply to FCS because the spent fuel pool cooling and cleanup system at FCS is stainless steel, while GALL Section VII.A3 applies to carbon steel. Therefore, general, pitting, and crevice corrosion are not applicable to stainless steel. The staff notes that for the spent fuel pool cooling system, the GALL Report also identifies loss of material for stainless steel components, but for a different water chemistry than that used at FCS. The staff agrees that loss of material due to general, pitting, and crevice corrosion is not applicable to the FCS spent fuel pool cooling system. POI-10(h) is resolved.

The staff reviewed link 3.3.3.01 in LRA Table 3.3-3 and compared the material and environment (stainless steel in a borated water environment) to Item V.D1.1-a in GALL, Volume 2, which is provided in the justification column for link 3.3.3.01. Item V.D1.1-a states that, for components made of stainless steel in a chemically treated borated water environment below 200 °F, GALL AMP XI.M2, "Water Chemistry," alone is adequate to manage crack initiation and growth due to SCC. The staff agrees that general, pitting, and crevice corrosion are not applicable to stainless steel under the conditions found in the FCS SFP cooling system. Therefore, the staff concludes that the chemistry program is adequate to manage aging of the SFP cooling system. POI-10(h) is resolved.

The staff reviewed the USAR Supplement for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for the auxiliary system components for which the applicant claimed consistency with GALL to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of material due to general, pitting, and crevice corrosion for components in the spent fuel pool cooling system that are covered by GALL.

3.3.2.2.2 Hardening and Cracking or Loss of Strength Due to Elastomer Degradation or Loss of Material due to Wear

The GALL Report recommends further evaluation of programs to manage hardening and cracking due to elastomer degradation of valves in the spent fuel pool cooling and cleanup system. The GALL Report also recommends further evaluation of programs to manage the hardening and loss of strength due to elastomer degradation of the collars and seals of the duct, and of the elastomer seals of the filters in the control room area, auxiliary and radwaste area, and primary containment heating and ventilation systems, and of the collars and seals of the duct in the diesel generator building ventilation system. The GALL Report also recommends further evaluation of programs to manage the loss of material due to wear of the collars and seals of the ducts in the ventilation systems. The staff reviewed the applicant's proposed programs to ensure that an adequate program will be in place for the management of these aging effects.

The applicant credited the periodic surveillance and preventive maintenance program and the general corrosion of external surfaces program for managing the aging effects of hardening and cracking or loss of strength due to elastomer degradation or loss of material due to wear for the above heating and ventilation components that are applicable to FCS auxiliary systems. The staff's evaluation of these AMPs is documented in Sections 3.0.3.10 and 3.0.3.12 of this SER, respectively.

This GALL/SRP item also addresses the hardening, cracking, and loss of strength due to elastomer degradation in the spent fuel pool cooling system. The applicant has stated that the FCS spent fuel pool cooling system does not contain elastomer-lined components. Therefore, this item is not applicable to the FCS spent fuel pool cooling system. The staff finds this reasonable and acceptable.

The staff reviewed the USAR Supplement for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for the auxiliary system components for which the applicant claimed consistency with GALL to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of hardening and cracking or loss of strength due to elastomer degradation or loss of material due to wear for components in the applicable FCS auxiliary systems, as recommended in the GALL Report.

3.3.2.2.3 Cumulative Fatigue Damage

Fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The staff reviewed the evaluation of this TLAA in Section 4.3 of this SER, following the guidance in Section 4.3 of the SRP-LR.

For the chemical and volume control system, the applicant identified that time-limited aging analyses are applicable to the filter/strainer housing, heat exchangers, pipes, fittings, and tubing, pump casings, tanks, and valve bodies. The applicant also identified a TLAA for the heat exchanger in the primary sampling system. The applicant discussed the TLAAs in Section

4.3.1 of the LRA, “Reactor Coolant and Associated System Fatigue.” This TLAA is evaluated in Section 4.3 of this SER.

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of cumulative fatigue damage for components in the applicable FCS auxiliary systems, as recommended in the GALL Report.

3.3.2.2.4 Crack Initiation and Growth Due to Cracking or Stress Corrosion Cracking

The GALL Report recommends further evaluation of programs to manage crack initiation and growth due to cracking of the high-pressure pump in the chemical and volume control system. The staff reviewed the applicant’s proposed program to ensure that an adequate program will be in place for the management of this aging effect.

The applicant proposes to use the chemistry program and the one-time inspection program to address crack initiation and growth due to cracking or stress corrosion cracking in the high pressure pump in the chemical and volume control system. The applicant will perform an inspection for cracking to verify that the chemistry program is effective in preventing cracking. The chemistry program and one-time inspection program are evaluated in Sections 3.0.3.2 and 3.0.3.13 of this SER, respectively. The one-time inspection program will be capable of detecting cracking, therefore, the staff finds the proposed inspections to be acceptable for managing the potential for cracking in the pump casing.

The staff reviewed the USAR Supplement for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for the auxiliary system components for which the applicant claimed consistency with GALL to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of crack initiation and growth due to cracking or stress corrosion cracking for the high pressure pump in the chemical and volume control system, as recommended in the GALL Report.

3.3.2.2.5 Loss of Material Due to General, Microbiologically-Influenced, Pitting, and Crevice Corrosion

The GALL Report recommends further evaluation of programs to manage the loss of material due to general, pitting, and crevice corrosion of the piping and filter housing and supports in (1) the control room area, the auxiliary and radwaste area, and the primary containment heating and ventilation systems, (2) the piping of the diesel generator building ventilation system, and (3) the above ground piping and fittings, valves, and pumps in the diesel fuel oil system, and of the diesel engine starting air, combustion air intake, and combustion air exhaust subsystems in the emergency diesel generator system. The GALL Report also recommends further evaluation of programs to manage the loss of material due to general, pitting, and crevice corrosion and MIC of the duct fittings, access doors, closure bolts, equipment frames, and housing of the duct due to pitting and crevice corrosion of the heating/cooling coils of the air handler, and due to general corrosion of the external surfaces of all carbon steel structures and components, including bolting exposed to operating temperatures less than 212 °F in the ventilation systems. The staff reviewed the applicant's proposed program to ensure that an adequate program will be in place for the management of these aging effects.

The applicant credits the PS/PMP, the general corrosion of external surfaces program, and the FPP for managing the aging effects of loss of material due to general, pitting, and crevice corrosion, and MIC for the above components that are applicable to FCS auxiliary systems. These programs periodically inspect for external corrosion, and initiate corrective actions if appropriate. The FPP, PS/PMP, and general corrosion of external surfaces program are evaluated in Sections 3.0.3.9, 3.0.3.10, and 3.0.3.12 of this SER, respectively. The staff finds that these programs can effectively manage corrosion in the above components that are applicable to FCS auxiliary systems.

The staff reviewed the USAR Supplement for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for the auxiliary system components for which the applicant claimed consistency with GALL to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of material due to general, MIC, pitting, and crevice corrosion for the above components in the applicable FCS auxiliary systems, as recommended in the GALL Report.

3.3.2.2.6 Loss of Material Due to General, Galvanic, Pitting, and Crevice Corrosion

The GALL Report recommends further evaluation of programs to manage the loss of material due to general, galvanic, pitting, and crevice corrosion of tanks, piping, valve bodies, and tubing in the reactor coolant pump oil collection system in fire protection. The GALL fire protection program relies on a combination of visual and volumetric examinations in accordance with the guidelines of 10 CFR Part 50, Appendix R, and BTP 9.5-1 to manage loss of material from corrosion. However, corrosion may occur at locations where water from washdowns may accumulate. Therefore, verification of the effectiveness of the program should be performed to ensure that degradation is not occurring and that the component's intended function will be maintained during the period of extended operation. The staff reviewed the applicant's proposed program to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

For the RCP oil collection portion of the fire protection system, the applicant proposes to use the one-time inspection program to manage the potential loss of material. The one-time inspection program is evaluated in Section 3.0.3.13 of this SER and is considered to be an acceptable method for verifying the intended function of the RCP oil collection portion of the fire protection system, and is consistent with GALL recommendations; therefore, the staff finds this acceptable.

The staff reviewed the USAR Supplement for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for the auxiliary system components for which the applicant claimed consistency with GALL to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of material due to general, galvanic, pitting, and crevice corrosion for the above components in the applicable FCS auxiliary systems, as recommended in the GALL Report.

3.3.2.2.7 Loss of Material Due to General, Pitting, Crevice, and MIC, and Biofouling

The GALL Report recommends further evaluation of programs to manage loss of material due to general, pitting, and crevice corrosion, and MIC, and due to biofouling of the internal surface of diesel fuel storage tanks. The GALL recommends a fuel oil chemistry program that relies on monitoring and control of fuel oil contamination in accordance with the guidelines of ASTM Standards D4057, D1796, D2709, and D2276 to manage loss of material due to corrosion or biofouling. Corrosion or biofouling may occur at locations where contaminants accumulate. Verification of the effectiveness of the fuel oil program should be performed to ensure that corrosion/biofouling is not occurring and that the component's intended function will be maintained during the period of extended operation. The staff reviewed the applicant's proposed program to ensure that corrosion/biofouling is not occurring and that the component's intended function will be maintained during the period of extended operation.

The applicant manages the internal surfaces of the tanks via its diesel fuel monitoring and storage program, which is evaluated in Section 3.3.2.3.1 of this SER. This program consists of oil chemistry control and inspections to verify that degradation is being adequately managed, consistent with GALL program XI.M30, "Fuel Oil Chemistry." Because the tank is inaccessible and because leakage detection does not detect leakage until a loss of intended function has already occurred, the applicant proposes to perform a one-time inspection of the fire protection diesel fuel oil prior to the period of extended operation to confirm that no significant degradation is occurring in the tank. The details of this issue are discussed in Section 3.3.2.3.1 of this SER.

The staff reviewed the USAR Supplement for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for the auxiliary system components for which the applicant claimed consistency with GALL to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of material due to general, pitting, crevice, and MIC, and biofouling for components in the various diesel fuel oil storage systems, as recommended in the GALL Report.

3.3.2.2.8 Crack Initiation and Growth Due to Stress Corrosion Cracking and Cyclic Loading

Crack initiation and growth due to SCC and cyclic loading could occur in the channel head and access cover, tubesheet, tubes, shell and access cover, and closure bolting of the regenerative heat exchanger, and in the channel head and access cover, tubesheet, and tubes of the letdown heat exchanger in the chemical and volume control system. The GALL chemistry program relies on monitoring and control of water chemistry based on the guidelines of TR-105714 for primary water chemistry to manage the effects of crack initiation and growth due to SCC and cyclic loading. The GALL Report recommends further evaluation to manage crack initiation and growth from SCC and cyclic loading for this system to verify the effectiveness of the water chemistry program. The staff reviewed the applicant's proposed program to ensure that cracking is not occurring and that the component's intended function will be maintained during the period of extended operation. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that crack initiation and growth are not occurring and that the components' intended functions will be maintained during the period of extended operation.

For the regenerative heat exchanger, the LRA indicates that the heat exchanger and its aging management were consistent with GALL. However, during discussions between the applicant and the NRC staff during the AMR inspection and audit conducted from January 6-10, 2003, and from January 20-23, 2003, it was identified that the regenerative heat exchanger construction is not consistent with GALL, and the GALL aging management could not be applied. The details of the staff's evaluation of the applicant's management of aging, including cracking of the regenerative heat exchanger, are discussed in Section 3.3.2.4.1 of this SER.

The LRA indicates that the letdown heat exchanger would be inspected for cracking and other aging effects, and that these inspections would be performed under the cooling water corrosion program, which is evaluated in Section 3.0.3.7 of this SER. In discussions with the staff during the AMR inspection and audit, the applicant confirmed that the heat exchanger inspections performed under the cooling water corrosion program would cover both the primary and cooling water sides of the heat exchanger. The staff finds that these inspections are acceptable for verifying the effectiveness of the chemistry program with respect to the letdown heat exchanger. The staff's evaluation of this heat exchanger can be found in Section 3.3.2.4.1 of this SER.

The staff reviewed the USAR Supplement for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for the auxiliary system components for which the applicant claimed consistency with GALL to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of crack initiation and growth due to stress corrosion cracking and cyclic loading for heat exchangers in the chemical and volume control system, as recommended in the GALL.

3.3.2.2.9 Reduction of Neutron-Absorbing Capacity and Loss of Material Due to General Corrosion

Reduction of neutron-absorbing capacity and loss of material due to general corrosion could occur in the neutron-absorbing sheets of the spent fuel storage rack. The GALL Report recommends further evaluation of programs to manage these aging effects. The staff reviewed the applicant's proposed program to ensure that an adequate program will be in place for the management of these aging effects.

The applicant stated that the PS/PMP would be used to address the potential reduction of neutron-absorbing capacity and loss of material due to general corrosion. The applicable components are scoped under structures and are discussed in Section 3.5.2.4.3 of this SER. LRA Table 3.3.1 states that the surveillance test evaluates the neutron-absorbing samples for dimensional change, weight change, neutron attenuation change, and specific gravity change.

The periodic surveillance and preventive maintenance program is evaluated in Section 3.0.3.10 of this SER.

The staff reviewed the USAR Supplement for the AMP and concludes that it provides an adequate summary description of the program credited for managing the effects of aging for the auxiliary system components for which the applicant claimed consistency with GALL to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the reduction of neutron-absorbing capacity and loss of material due to general corrosion for components (scoped in structures and discussed in Section 3.5.2.4.3 of this SER) that use this item, as recommended in the GALL Report.

3.3.2.2.10 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

Loss of material due to general, pitting, and crevice corrosion and MIC could occur in the underground piping and fittings in the open-cycle cooling water system (service water system) and in the diesel fuel oil system. The buried piping and tanks inspection program, described in GALL XI.M34, relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, and crevice corrosion, and MIC. The staff reviews the effectiveness of the buried piping and tanks inspection program, including its inspection frequency and operating experience, to ensure that loss of material is not occurring and that the component’s intended function will be maintained during the period of extended operation.

The applicant credits the buried surfaces external corrosion program for managing the potential loss of material on buried external surfaces. The staff’s evaluation of this program is discussed in Section 3.3.2.3.2 of this SER.

An exception to the use of the buried surfaces external corrosion program is the aging management of the fire protection diesel fuel oil tank and associated piping and fittings. These components are above ground, buried in gravel inside a concrete enclosure, and inaccessible. For these components, the applicant had proposed to use leakage detection under the diesel fuel monitoring and storage program to detect degradation on the internal and external surfaces. In response to the staff’s concerns with the use of leakage detection, the applicant has stated that a one-time inspection will be used to evaluate the condition of the tank. The details of the staff’s evaluation of this issue is discussed in Section 3.3.2.3.1 of this SER.

The staff reviewed the USAR Supplement for the AMP and concludes that it provides an adequate summary description of the program credited for managing the effects of aging for the auxiliary system components for which the applicant claimed consistency with GALL to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of material due to general, pitting, crevice, and MIC, for buried components in the auxiliary systems, as recommended in the GALL Report.

3.3.2.2.11 Conclusions

The staff has reviewed the applicant's evaluation of the issues for which GALL recommends further evaluation for components in the auxiliary systems. On the basis of its review, the staff finds that the applicant has provided sufficient information to demonstrate that the issues for which the GALL recommends further evaluation have been adequately addressed, and that the subject aging effects will be adequately managed for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the USAR Supplements for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for the auxiliary system components for which the applicant claimed consistency with GALL, as required by 10 CFR 54.21(d).

3.3.2.3 Aging Management Programs for Auxiliary System Components

To perform its evaluation, the staff reviewed the components listed in LRA Tables 2.3.3.1-1 through 2.3.3.3-20 to determine whether the applicant had properly identified the applicable AMRs and AMPs needed to adequately manage the aging effects for the components. This portion of the staff review involved identification of the aging effects for each component, ensuring that each aging effect was evaluated using the appropriate AMR in Section 3, and that management of the aging effect was captured in the appropriate AMP. The results of the staff's review are provided below.

The applicant credits 14 AMPs to manage the aging effects associated with components in the auxiliary systems. Twelve of the AMPs are credited to manage aging for components in other system groups (common AMPs), while two AMPs are credited to manage aging only for auxiliary system components. The staff's evaluation of the common AMPs credited with managing aging in auxiliary system components is provided in Section 3.0.3 of this SER. The common AMPs are listed below:

- Bolting Integrity Program - SER Section 3.0.3.1
- Chemistry Program - SER Section 3.0.3.2
- Inservice Inspection Program - SER Section 3.0.3.5
- Boric Acid Corrosion Prevention Program - SER Section 3.0.3.6
- Cooling Water Corrosion Program - SER Section 3.0.3.7
- Fatigue Monitoring Program - SER Section 3.0.3.8
- Fire Protection Program - SER Section 3.0.3.9
- Periodic Surveillance and Preventive Maintenance Program - SER Section 3.0.3.10
- Structures Monitoring Program - SER Section 3.0.3.11
- General Corrosion of External Surfaces Program - SER Section 3.0.3.12
- One-Time Inspection Program - SER Section 3.0.3.13
- Selective Leaching Program - SER Section 3.0.3.14

The staff's evaluation of the two auxiliary system AMPs are provided below.

3.3.2.3.1 Diesel Fuel Monitoring and Storage Program

The diesel fuel monitoring and storage program is described in Section B.2.3 of Appendix B to the LRA. The applicant credits this program with managing components in the diesel generator lube oil and fuel oil system and the auxiliary boiler fuel oil and fire protection fuel oil system. The staff reviewed the diesel fuel monitoring and storage program to determine whether the applicant has demonstrated that the program will adequately manage the applicable effects of aging during the period of extended operation as required by 10 CFR 54.21(a)(3).

3.3.2.3.1.1 Summary of Technical Information in the Application

The LRA states that the diesel fuel monitoring and storage program is consistent with GALL program XI.M30, “Fuel Oil Chemistry,” with the following two clarifications: (1) the applicant does not credit the oil particulate analysis with aging management, and (2) the applicant does not perform ultrasonic testing on the fire protection diesel fuel oil tank due to inaccessibility. The LRA also states that the existing program will be enhanced to (1) add a preventative action to remove sediment and water from the bottom of the fire protection diesel fuel oil tank, (2) inspect the diesel fuel day tanks for corrosion, and (3) perform analysis of fuel in the fire protection day tank. In addressing the operating experience related to the program, the applicant stated that there have been no instances of fuel oil system component failures due to aging effects.

3.3.2.3.1.2 Staff Evaluation

Section B.2.3 of the LRA describes the applicant’s diesel fuel monitoring and storage program. The LRA states that this AMP is consistent with GALL program XI.M30, “Fuel Oil Chemistry,” with the following two clarifications: (1) the applicant does not credit the oil particulate analysis with aging management, and (2) the applicant does not perform ultrasonic testing on the fire protection diesel fuel oil tank due to inaccessibility. With regard to the ultrasonic testing, the staff considers this an exception to GALL, not a clarification, using the definitions in Section 3.0.2 of this SER. The staff confirmed the applicant’s claim of consistency, with clarifications, during the AMR inspection. Furthermore, the staff reviewed the clarifications and enhancements and their justifications to determine whether the program, with the clarifications, exceptions, and enhancements, remains adequate to manage the aging effects for which it is credited, and reviewed the USAR Supplement to determine whether it provides an adequate description of the program.

In addition to the above, the staff verified that the components in Tables 3.3-2 and 3.3-3 of the LRA, to which this program applies, are commensurate with the intent of GALL program XI.M30. The staff finds the components to be generally acceptable, however, the staff notes that the applicant used the diesel fuel monitoring and storage program to manage the external corrosion of buried tanks and piping. In its December 19, 2002, response to RAI 3.3.2-3, the applicant stated that the proposed leakage detection activities, described below, would be used to monitor the loss of material of the internal and external surface of the fire protection diesel fuel oil tank and its associated piping and fittings. As described below, the staff found that the applicant had not proposed adequate aging management for the fire protection diesel fuel oil tank and its associated piping and fittings.

The staff reviewed the justification provided by the applicant relating to the exception to the GALL program. Leak detection is being employed to monitor the condition of the fire protection diesel fuel oil tank in lieu of ultrasonic testing due to inaccessibility. The staff believes that ultrasonic testing allows for the detection of aging effects in sufficient time to take corrective action to maintain the component's intended function. Detection of a leak indicates that significant fuel oil tank degradation has already occurred. On this basis, the staff believes that leak detection is an insufficient means to detect tank degradation. Therefore, in RAI B.2.3-1, the staff asked the applicant to (1) provide an aging management program that will adequately detect tank degradation in sufficient time to allow for corrective action before loss of the tank's intended function, or justify how leakage detection will accomplish this goal, (2) discuss the corrective actions that would be taken if leakage is detected, (3) clarify whether inspections will be performed in the other storage tanks which credit this program for aging management, and (4) describe the aging management of other low points of the system where impurities can accumulate.

The applicant responded to RAI B.2.3-1 by letter dated December 19, 2002. With regard to items (1) and (2), the applicant stated that the leakage detection under the diesel fuel monitoring and storage program would be used since ultrasonic testing cannot be performed on this tank due to inaccessibility. In describing the construction of the tank, the applicant stated that the fire protection diesel fuel oil tank is above ground, surrounded by gravel, and enclosed in a concrete structure. The concrete structure is surrounded by a concrete berm, and the enclosure drains to the berm area. The diesel fuel monitoring and storage program credits two leak detection activities. The first activity involves operator rounds recording whether any oil sheen was seen in this berm area. The second activity is to identify, via level readings, any leakage from the tank between monthly surveillances, while accounting for periodic oil replenishment. The applicant concluded that leak detection is adequate to maintain system design requirements because the applicant has seven days to restore the inoperable equipment to operable status, and that seven days is ample time to make necessary repairs or bring in a portable diesel fuel supply. The applicant also stated that past visual inspections and UT of the diesel generator tanks, which are of the same material as the fire protection fuel storage tank, have not indicated degradation. Further, new fuel additions to the fire protection diesel fuel oil tank will be analyzed for water and sediment, and the tank bottoms will be monitored to ensure water or biological activity are not accumulating.

The staff notes that the applicant continues to rely on leakage detection to monitor for internal and external corrosion of the fire protection diesel fuel tank and the associated piping. The LRA states that the diesel fuel monitoring and storage program will be enhanced to add the removal of sediment and water from the bottom of the fire protection diesel fuel tank, which indicates that this has not historically been performed. The current condition of the tank is unknown, and the staff does not consider leakage detection to be effective aging management for internal and external corrosion of the tank, pipes, fittings, and tubing. If the applicant is going to rely on leakage detection, additional justification is required. It was the staff's position that, at a minimum, the applicant should provide information on the current condition of the tank, and associated piping and fittings, to justify that the condition of this tank is comparable to other fuel oil storage tanks. In addition, the staff believed that the applicant would need to explain why the inspections of other tanks, performed under this program, would be leading indicators of degradation of the fire protection diesel fuel oil tank, considering that the oil in the fire protection diesel fuel oil tank has not been maintained to the same standards (as implied by the LRA statements that actions would be added to remove water and sediment from the bottom of the tank). Also, in justifying why leakage detection is the appropriate aging detection method, the applicant should explain why boroscopes or other instruments cannot be used to evaluate the condition of the tank internals and piping internals. Finally, the applicant should describe any measures that have been taken to maintain the tank and piping externals in a benign environment, thereby minimizing the potential for loss of material. These concerns were provided to the applicant in POI-7(c), in a letter dated February 20, 2003. By letter dated March 14, 2003, the applicant responded to the POI, by committing to a one-time inspection of the fire protection diesel fuel oil tank prior to the period of extended operation to verify that the tank is not in a degraded condition. The staff finds this approach acceptable. POI-7(c) is resolved.

With regard to item (3) of RAI B.2.3-1, by letter dated December 19, 2002, the applicant stated that UT and/or visual inspections will be performed in the other storage tanks which credit this program for aging management. In response to item (4) of the RAI, the applicant stated that the low point beyond the main tank is the bottom of the day tank, and the day tank sample will be drawn from the bottom of the tank and analyzed for water and sediment. The staff finds these activities reasonable and acceptable, and considers the RAI issues closed.

In RAI B.2.3-2, the staff asked the applicant to discuss the nature of the fuel analysis and day tank inspection, including the constituents to be analyzed, the frequency of the analyses and inspections, the acceptance criteria, and the corrective actions if degradation is found. In its December 19, 2002, response, the applicant stated that the day tank activities addressed in this question are enhancements and are not the only aging management activities for these tanks. The applicant stated that the inspections for the other tanks are consistent with GALL program XI.M30. The specific activities are (1) the DG day/engine tanks will be cleaned, flushed, and visually inspected every third refueling outage; (2) the fire protection day tank will have a one-time boroscope inspection performed; (3) the DG day tanks have water and sediment analysis performed semi-annually; (4) the DG engine tanks have water and sediment analysis and microbiological activity performed semi-annually; and (5) the fire protection day tank will be sampled quarterly for water and sediment, and semi-annually for microbiological activity. The acceptance criteria for water and sediment is less than 0.05 percent by volume, and the acceptance criteria for microbiological activity is “none detectable.” Due to the monthly surveillance runs, the fuel in the day/engine tanks does not remain stagnant and would not warrant quarterly analyses. If degradation is found to exceed Class C cleanliness (thin uniform rust or magnetite films are acceptable, and scattered areas of rust are permissible provided that the area of rust does not exceed 15 square inches in 1 square foot on corrosion resistant alloys), corrective actions are initiated. The staff finds the applicant’s response reasonable and acceptable, and the RAI B.2.3-2 issues are resolved.

Regarding the GALL clarification related to the applicant electing not to credit particulate analyses for aging management, in RAI B.2.3-3, the staff asked the applicant to confirm whether the diesel fuel oil quality is monitored for water and sediment contamination in accordance with ASTM Standards D1796 and D2709, as stated in XI.M30 of the GALL. In its response dated December 12, 2002, the applicant clarified that ASTM D2709 is only used for water and sediment analyses. ASTM D2709 is a newer method specific to Middle Distillate Fuels (which includes #2 diesel fuel), whereas ASTM D1796 was an older method for all fuel oils. There would be no need to use both. In accordance with ASTM D2709, test method D1796 is intended for higher viscosity fuel oils. The applicant’s response satisfactorily resolves the staff’s concern related to RAI B.2.3-3.

The staff reviewed the summary description of the diesel fuel monitoring and storage program in Appendix A of the LRA and finds that the information in the USAR Supplement provides an adequate summary of the program activities as required by 10 CFR 54.21(d).

3.3.2.3.1.3 Conclusions

On the basis of its review and inspection of the applicant's program, the staff finds that those portions of the program for which the applicant claims consistency with GALL are consistent with GALL. In addition, the staff has reviewed the exceptions, clarifications, and enhancements to the GALL program and finds that the applicant's program provides for adequate management of the aging effects for which the program is credited. The staff also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program to satisfy 10 CFR 54.21(d).

Therefore, on the basis of its review, the staff concludes that, pending satisfactory implementation of the commitment discussed above, the applicant has demonstrated that the diesel fuel monitoring and storage program will effectively manage aging in the components for which this program is credited, so that the intended functions of the associated components and systems 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 Buried Surfaces External Corrosion Program

3.3.2.3.2.1 Summary of Technical Information in the Application

The applicant's buried surfaces external corrosion program is discussed in LRA Section B.3.2, "Buried Surfaces External Corrosion Program." The applicant states that the program will be consistent with GALL program XI.M34, "Buried Piping and Tanks Inspection." This program will include surveillances and preventive measures to mitigate corrosion of external surfaces of buried carbon steel piping and tanks.

The applicant described in its operating experience that tank wall thickness measurements have determined that there is no indication of external corrosion for either the diesel generator or auxiliary boiler fuel oil storage tanks. These measurements were conducted as part of the applicant's diesel fuel oil monitoring and storage program. In addition, visual inspections have been performed on excavated piping. The most recent excavation exposed sections of buried raw water and fire protection systems piping. The applied coatings and wrappings on these exposed sections were found to be in good condition with no indication of loss of material from the base metal.

3.3.2.3.2.2 Staff Evaluation

In LRA Section B.3.2, the applicant described its AMP to manage the aging effects in buried components. The LRA stated that this AMP will be consistent with GALL AMP XI.M34, "Buried Piping and Tanks Inspection," with no deviations. The staff confirmed the applicant's claim of consistency during the AMR inspection. The staff also reviewed the USAR Supplement to determine whether it provides an adequate description of the program.

By letter dated October 11, 2002, the staff requested, in RAI B.3.2-1, the applicant to discuss the changes that will be made to the current program in order to make it consistent with the GALL AMP. By letter dated December 12, 2002, the applicant responded that this is a new program which will be implemented prior to the period of extended operation. In addition, this new program will include the following to make it consistent with the GALL AMP:

- A revision has been completed to the FCS maintenance control procedure to require engineering evaluation of concrete, piping, and piping coatings whenever excavations are performed.

- Current routine inspections of diesel fuel oil tanks within the scope of license renewal will be annotated to include commitments required to meet license renewal requirements.

- A program basis document will be developed which will define the program requirements and compile industry and FCS operating experience related to buried components.

In its AMR inspection and audit conducted from January 6-10, 2003, and from January 20-23, 2003, the staff confirmed that the applicant has developed an action request to develop the program basis document. These items are also part of the applicant's commitments, as identified in Appendix A of this SER.

By letter dated October 11, 2002, in RAI B.3.2-2, the staff requested the applicant to expand the discussion of this AMP to include a breakdown (system name, component, and percentage of total buried components) of the components in systems within the scope of this program, the inspection frequency, and the applicable operating experience. In addition, the staff requested the applicant to discuss how often these buried components have been excavated during the current operating term and how often the components may be excavated during the period of extended operation. The staff also requested a discussion on how the activities used to assess component internal conditions can be used to assess the condition of the component exterior.

In its response dated December 19, 2002, the applicant responded that the scope of the buried surfaces external corrosion program includes the following:

- Raw Water System – approximately 900 ft of carbon steel piping running between the Intake Structure and the Auxiliary Building

- Diesel Generator Fuel Oil System – the diesel fuel oil tank and approximately 100 ft of carbon steel piping between the tank and the Auxiliary Building

- Auxiliary Boiler Fuel Oil System – the auxiliary boiler fuel oil tank, approximately 50 ft of carbon steel pipe between the tank and the Turbine Building, and approximately 50 ft of copper tubing between the tank level indicator and the Turbine Building

- Fire Protection System – approximately 56 ductile iron valves and hydrants and the short sections of ductile iron piping connecting them to the asbestos-cement fire protection header

The applicant further responded that buried piping and tanks will be inspected when portions are excavated for maintenance. Part of the applicant's PM tasks includes defueling, cleaning, and inspecting the emergency diesel and auxiliary boiler diesel fuel tanks on a 9-year frequency. The most recent inspection of the emergency diesel and auxiliary boiler fuel tanks was performed in 1995 and resulted in no UT indication of degradation. UT is also performed on the internal surfaces of the tanks to identify any loss of material, which may be occurring due to corrosion on the external surfaces. The applicant has scheduled future tank inspections to be performed in 2004, which will include a UT of the excavated portions of the tanks' surfaces. The top of the tank's exterior surface around the vent and fill pipes will be excavated to conduct a visual inspection of the pipes, tank surface, welded connections, and hold down bands.

The applicant provided the results of maintenance activities performed on the emergency diesel generator fuel oil storage tanks in 1987. The inspection included a UT inspection. The results showed that the original tank wall thickness has been maintained, the welds were satisfactory, and there was no evidence of pitting. In general, the inspection showed the tank to be in excellent condition. The applicant also performed excavations of buried piping in 2000, 2001, and 2002, exposing sections of the fire protection and raw water system piping. These excavations were performed to repair degraded valves, repair potable water piping, and make modifications to fire protection system piping. Based on discussions with FCS system engineers and photos taken of exposed sections of the buried piping, the applicant concluded that the pipe coatings are well maintained with no evidence of degradation. These excavations are typically performed every 2 to 3 years.

Based on the applicant's responses, the staff finds that the elements of this new program will meet the intent of the GALL AMP because it includes visual and non-destructive examination of representative components at a frequency to ensure proper detection and correction of a degraded condition.

The applicant provided its USAR Supplement for the buried surfaces external corrosion program in LRA Section A.2.4. The staff reviewed the USAR Supplement and finds that the summary description contains a sufficient level of information to satisfy 10 CFR 54.21(d).

3.3.2.3.2.3 Conclusions

On the basis of its review and inspection of the applicant's program, the staff finds that the program is consistent with GALL. The staff also reviewed the USAR Supplement for this aging management program and finds that it provides an adequate summary description of the program to satisfy 10 CFR 54.21(d).

Therefore, on the basis of its review, the staff concludes that the buried surfaces external corrosion program will effectively manage aging in the structures and components for which this program is credited, to ensure that the structures and components will perform their intended functions in accordance with the current licensing basis during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.4 Aging Management Reviews of Auxiliary System Components

In SER Sections 3.3.2.1 and 3.3.2.2, the staff determined that the applicant's AMRs and associated AMPs will adequately manage component aging in the auxiliary systems for components that the applicant claims are consistent with the GALL Report. SER Section 3.3.2.3 provides the results of the staff's evaluation of the aging management programs credited with managing the aging of components in the auxiliary systems. The staff then reviewed specific components in the auxiliary systems to ensure that they were properly evaluated in the applicant's AMR.

To perform its evaluation, the staff reviewed the components listed in LRA Tables 2.3.3.1-1 through 2.3.3.3-20 to determine whether the applicant had properly identified the applicable AMRs and AMPs needed to adequately manage the aging effects for the components. This portion of the staff review involved identification of the aging effects for each component, ensuring that each aging effect was evaluated using the appropriate AMR in Section 3, and that management of the aging effect was captured in the appropriate AMP. The results of the staff's review are provided below.

The staff also reviewed the USAR Supplements for the AMPs credited with managing aging in auxiliary system components to determine whether the program description adequately describes the program.

3.3.2.4.1 Chemical and Volume Control

3.3.2.4.1.1 Summary of Technical Information in the Application

The description of the chemical and volume control system (CVCS) can be found in Section 2.3.3.1 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.3.1-1. The components, aging effects, and AMPs are provided in LRA Tables 3.3-1, 3.3-2, and 3.3-3.

Aging Effects

Table 2.3.3.1-1 of the LRA lists individual system components that are within the scope of license renewal and subject to an AMR. The components include bolting, filter/strainer housing, flow element/orifice, heat exchanger, ion exchangers, pipes, fittings, tubing, pump casings, tanks, and valve bodies.

The LRA states that carbon steel, cast iron, galvanized steel, and cadmium-plated steel in air are subject to loss of material due to general external corrosion, while carbon steel and ductile iron in dripping boric acid are subject to boric acid corrosion. Carbon steel and low-alloy steel closure bolting is subject to loss of material and cracking. Stainless steel in chemically-treated borated water is subject to cracking due to SCC and cyclic loading, and stainless steel in corrosion-inhibited treated water is subject to loss of material due to general, pitting, and crevice corrosion, and MIC. Heat-traced stainless steel in indoor plant air is subject to cracking due to possible leaching of chemicals from the adhesives combined with temperatures in excess of 160 °F. Carbon steel and high-strength low alloy steel with stainless steel cladding in treated water is subject to loss of material due to general, pitting, and crevice corrosion. Several carbon steel and stainless steel components are also subject to fatigue. Brass and copper alloy in treated water are subject to loss of material due to pitting and crevice corrosion, galvanic corrosion due to dissimilar metals and MIC. Brass in treated water is also subject to cracking due to SCC, and brass in lubricating oil (with potential water contamination) is subject to loss of material. The LRA does not identify any aging effects for stainless steel, brass, or bronze in air, or for carbon steel or stainless steel in hydrogen.

Aging Management Programs

The following AMPs are utilized to manage aging effects in the CVCS:

- Bolting Integrity Program (B.1.1)
- Chemistry Program (B.1.2)
- Inservice Inspection Program (B.1.6)
- Boric Acid Corrosion Program (B.2.1)
- Cooling Water Corrosion Program (B.2.2)
- Periodic Surveillance and Preventive Maintenance Program (B.2.7)
- General Corrosion of External Surfaces Program (B.3.3)
- One-Time Inspection Program (B.3.5)

The filter/strainer housing, heat exchangers, pipes, fittings, tubing, pump casings, tanks, and valve bodies are also covered by time-limited aging analyses to address fatigue.

A description of these AMPs is provided in Appendix B of the LRA.

3.3.2.4.1.2 Staff Evaluation

Aging Effects

The staff reviewed the information in LRA Tables 2.3.3.1-1, 3.3-1, 3.3-2, and 3.3-3 for the CVCS, as well as the applicant’s responses to the staff’s requests for additional information.

In its December 12, 2002, response to RAI 3.3-1, the applicant revised links related to stainless steel valve bodies. The new links clarify that the stainless steel valve bodies are subject to cracking and loss of material, and aging management will be consistent with GALL. The staff finds the clarification to be reasonable, and considers the questions regarding these links to be resolved.

In its December 19, 2002, response to RAI 3.3.1-15, the applicant clarified that only the heat exchangers would rely on link 3.3.1.08, and that other items in the CVCS would use link 3.3.3.01. Link 3.3.3.01 is for stainless steel in borated treated water, and uses the chemistry program to manage cracking due to SCC. This aging effect and aging management are consistent with the GALL for components with similar material and environments; therefore, the staff finds this acceptable and considers the issues related to RAI 3.3.1-15 resolved.

Under “valve bodies,” LRA Table 2.3.3.1-1 cites link 3.1.1.25. This link covers several items in the RCS. In its December 12, 2002, response to RAI 3.3-1, the applicant clarified that this link is for a cast austenitic stainless steel valve body in chemically treated borated water, and that the aging management would consist of the chemistry program and the ISI program. The staff considers this clarification reasonable, and notes that the aging management is consistent with GALL; therefore, the staff finds this acceptable and considers this RAI issue resolved.

By letter dated October 11, 2002, the staff issued RAI 3.3-2 pertaining to the description of the internal and external environments included in the LRA. The staff's evaluation of the applicant's response is documented in Section 3.3.2.5.1 of this SER and is characterized as resolved.

Based on its review of LRA Tables 2.3.3.1-1, 3.3-1, 3.3-2, and 3.3-3, and the applicant's responses to the requests for additional information, the staff finds that the aging effects identified for the CVCS components are generally consistent with industry experience for these combinations of materials and environments. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the CVCS.

Aging Management Programs

The applicant credited the following AMPs for managing the aging effects in the CVCS:

- Bolting Integrity Program (3.0.3.1)
- Chemistry Program (3.0.3.2)
- Inservice Inspection Program (3.0.3.5)
- Boric Acid Corrosion Program (3.0.3.6)
- Cooling Water Corrosion Program (3.0.3.7)
- Periodic Surveillance and Preventive Maintenance Program (3.0.3.10)
- General Corrosion of External Surfaces Program (3.0.3.12)
- One-Time Inspection Program (3.0.3.13)

These AMPs are credited for managing the aging effects of components in several structures and systems and, therefore, are considered common AMPs. The staff has evaluated these common AMPs and has found them to be acceptable for managing the aging effects identified for this system. These AMPs are evaluated in Sections 3.0.3.1, 3.0.3.2, 3.0.3.5, 3.0.3.6, 3.0.3.7, 3.0.3.10, 3.0.3.12, and 3.0.3.13 of this SER, respectively.

The fatigue of the CVCS components is addressed by the TLAAs in Section 4.3.1 of the LRA, "Reactor Coolant and Associated System Fatigue." This TLAA is evaluated in Section 4.3 of this SER.

In RAI 3.3-1, the staff asked for clarification for several links in the LRA. In its response dated December 12, 2002, the applicant clarified that link 3.3.1.08 would be used instead of 3.4.1.10 for the letdown heat exchanger. Link 3.3.1.08 addresses crack initiation and growth due to SCC and cyclic loading of stainless steel exposed to (for the letdown heat exchanger) chemically treated borated water on the primary side, and closed cycle cooling water on the secondary side. In discussions with the staff during the AMR inspection and audit, the applicant clarified that, for the letdown heat exchanger, inspections performed under the cooling water corrosion program would be used to verify the effectiveness of the chemistry program, and that the inspections would cover both the primary side and the cooling water side of the heat exchanger. The staff finds that the inspections are consistent with GALL recommendations and, therefore, acceptable. By letter dated February 20, 2003, the staff issued POI-10(a), requesting that this information be provided formally. By letter dated March 14, 2003, the applicant provided the requested information. POI-10(a) is resolved.

For the regenerative heat exchanger, which is constructed of stainless steel and exposed to chemically treated borated water, LRA Table 2.3.3.1-1 cited link 3.3.1.08 for aging management of cracking due to SCC, consistent with the GALL Report. This link stated that the aging management will consist of the chemistry program, with the effectiveness of the chemistry program verified by inspections performed using either the one-time inspection program, cooling water corrosion program, or periodic surveillance and preventive maintenance program. In discussions during the AMR inspection and audit, the applicant stated that the regenerative heat exchanger is welded such that the internals are not accessible. Due to its construction, the applicant stated that the aging management of the regenerative heat exchanger would consist of the chemistry program, with further evaluation of cracking due to SCC provided by inspection of the welds via the ISI program. The applicant considered this adequate aging management to support the pressure boundary intended function of the heat exchanger shell. Though the staff agrees that this is acceptable for the external pressure boundary, the staff notes that it would not detect degradation of the regenerative heat exchanger internals which could allow inventory to flow from the charging to the letdown side of the CVCS. This would reduce the effectiveness of the CVCS for managing RCS chemistry, and may also reduce the ability of the system to inject borated water during an event. Therefore, the proposed aging management may not be adequate to ensure that this intended function of the heat exchanger is maintained.

By letter dated February 20, 2003, the staff issued POI-10(b) and POI-10(i) requesting the applicant to describe inspections of the regenerative heat exchanger internals that would verify the absence of the identified aging effects, or to justify that degradation of the internals would not result in loss of function. By letter dated March 14, 2003, the applicant responded to POI-10(b) and POI-10(i), stating that a potential failure of the internal boundary between the two sides of the regenerative heat exchanger would not affect the inventory available for injection during an accident. The only function of the boundary is to provide for heat transfer during normal letdown operation. This function is not required during an accident. On the basis of its review of the information in the POI responses, the staff finds that the applicant's response does not explain how the plant can withstand the regulated events if the pressure boundary fails.

This pressure boundary function is important for at least two reasons over and above the normal CVCS function of maintaining RCS water chemistry. The first reason involves getting adequate boron injection during an event. The second reason involves isolating a letdown line break, which is a containment bypass LOCA (note that the CVCS injection path is the normally used path for the controlled cooldown during Appendix R events).

With regard to injection during an event, letdown is designed to isolate during any event in which there is a need for injection. If the letdown heat exchanger tubes leak sufficiently, there could be a continued loss of inventory via the letdown flowpath because one of the two letdown isolation valves is upstream of the heat exchanger, and would be bypassed. This would leave a single valve to isolate letdown and support injection.

Letdown is also designed to isolate during any breaks in the system to stop containment bypass. Again, if the letdown heat exchanger tubes leak sufficiently, the inboard isolation valve would be bypassed and a single train/single valve would now be relied on to stop the containment bypass LOCA.

On the basis of this information, the staff requested the applicant to provide additional information to demonstrate how degradation of the heat exchanger internals will not adversely impact the injection function, or to provide information on how the internals will be managed during the period of extended operation to ensure that the injection function is maintained. This was identified as Open Item 3.3.2.4.1.2-1.

By letter dated July 7, 2003, the applicant stated, in part, the following.

> ...flow through a tube leak in the regenerative heat exchanger (RHX) is not possible during design basis events (DBEs) because the letdown (tube) side of the RHX would be isolated in response to the events. This isolation would occur automatically upstream at the inboard containment isolation valve from the hot leg (TCV-202), and downstream at the outboard containment isolation valve (HCV-204). Backflow from the RCS through the RHX shell side is not possible due to the charging header check valves to the loops (CH-283 and -284) and the spray line (CH-285). Additionally, the containment isolation valves, as well as the letdown control valves (LCV-101-1 and -2), fail closed upon loss of air, loss of power, or loss of signal. The charging pumps, the RHX, and letdown are not credited in the USAR Chapter 14 safety analyses for plant shutdown nor are they used during a DBE (see Section 9.2.5 of the USAR).

The staff reviewed the information in the FCS USAR and the applicant's letter dated July 7, 2003, related to flow through the RHX tubes during design basis events or the regulated events covered by 10 CFR Part 54. The staff also considered whether the RHX tubes should be considered a design feature that was inherently credited to mitigate a release in the event of a CVCS line break (e.g., the charging line or the letdown line outside containment). The staff concludes that, due to the design of the FCS CVCS and the operation of the CVCS isolation valves, there is no credible scenario that would result in flow through the RHX tubes during design basis events or the regulated events covered by 10 CFR Part 54, and that pressure integrity of the RHX tubes is not required to isolate flow during a CVCS line break. Therefore, the staff concludes that degradation of the RHX tubes will not result in the loss of component and CVCS intended functions. Open Item 3.3.2.4.1.2-1 is closed.

RAIs 3.3.1-6 and 3.3.2-2 relate to bolting. In its response dated December 19, 2002, the applicant clarified that, consistent with GALL, bolting in high energy systems would be managed through the bolting integrity program, while the bolting in low and moderate energy systems would be managed through other programs, such as the PS/PMP or the general corrosion of external surfaces program. The response to RAI 3.3.2-2 clarified that the bolting integrity program is credited for aging management of bolting in the CVCS, including stainless steel bolting, even though the cited link (3.3.1.23) only covers carbon steel and low-alloy bolting. The staff finds that the bolting integrity program is appropriate for the bolting in the high-energy portions of the CVCS; therefore, the staff finds this acceptable and considers RAIs 3.3.1-6 and 3.3.2-2, related to bolting in the CVCS, resolved.

The applicant's December 19, 2002, response to RAI 3.3.3-2, clarified the aging management related to link 3.3.3.03. For the CVCS, this link is used for pipes, fittings, and valve bodies for loss of material. The aging management will consist of the chemistry program, and the effectiveness of the chemistry program will be verified through inspections performed under the one-time inspection program. The staff finds that this is consistent with GALL for these material and environment combinations; therefore, the staff finds this acceptable and considers RAI 3.3.3-2 resolved.

For stainless steel pipes that are heat traced and exposed to indoor air, the applicant states that cracking from SCC is possible due to chemicals leaching from the adhesives combined with temperatures exceeding 160 °F. The applicant proposes to use the one-time inspection program to determine whether further actions are required. The staff finds that the one-time inspection program is capable of detecting cracking, and is appropriate for this material and environment combination, and is, therefore, acceptable.

On the basis of its review the staff finds that the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with CVCS. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

3.3.2.4.1.3 Conclusions

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and has adequate AMPs and TLAAs for managing the aging effects, for components in the CVCS, such that the component intended functions will be maintained consistent with the CLB for the period of extended operation to satisfy 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR Supplement program descriptions and concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in the CVCS to satisfy 10 CFR 54.21(d).

3.3.2.4.2 Spent Fuel Pool Cooling

3.3.2.4.2.1 Summary of Technical Information in the Application

The description of the spent fuel pool cooling system (SFPC) can be found in Section 2.3.3.2 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.3.2-1. The components, aging effects, and AMPs are provided in LRA Tables 3.3-1, 3.3-2, and 3.3-3.

Aging Effects

Table 2.3.3.2-1 of the LRA lists individual system components that are within the scope of license renewal and subject to an AMR. The components include bolting, filter/strainer housing, heat exchangers, pipes and fittings, pump casings, and valve bodies.

The LRA states that carbon steel in air is subject to loss of material due to general external corrosion, and carbon steel in dripping boric acid is subject to boric acid corrosion. The LRA also identifies that stainless steel in treated borated water, and in corrosion-inhibited treated water, is subject to cracking due to SCC and loss of material. Carbon steel and high strength, low-alloy steel with stainless steel cladding in corrosion-inhibited treated water are subject to loss of material due to general, pitting, and crevice corrosion, and MIC. The LRA does not identify any aging effects for stainless steel in air.

Aging Management Programs

The following AMPs are utilized to manage aging effects in the SFPC:

- Chemistry Program (B.1.2)
- Cooling Water Corrosion Program (B.2.2)
- Periodic Surveillance and Preventive Maintenance Program (B.2.7)
- General Corrosion of External Surfaces Program (B.3.3)
- One-Time Inspection Program (B.3.5)

A description of these AMPs is provided in Appendix B of the LRA.

3.3.2.4.2.2 Staff Evaluation

Aging Effects

The staff reviewed the information in LRA Tables 2.3.3.2-1, 3.3-1, 3.3-2, and 3.3-3 for SFPC, as well as the applicant's responses to the staff's requests for additional information.

By letter dated October 11, 2002, the staff issued RAI 3.3-2 pertaining to the description of the internal and external environments included in the LRA. The staff's evaluation of the applicant's response is documented in Section 3.3.2.5.1 of this SER and is characterized as resolved.

On the basis of review of LRA Tables 2.3.3.2-1, 3.3-1, 3.3-2, and 3.3-3, and the information included in the applicant's response to the staff's RAI, the staff finds that the aging effects identified for the SFPC components are consistent with industry experience for these combinations of materials and environments. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the SFPC system.

Aging Management Programs

The applicant credited the following AMPs for managing the aging effects in the SFPC:

- Chemistry Program
- Cooling Water Corrosion Program
- Periodic Surveillance and Preventive Maintenance Program
- General Corrosion of External Surfaces Program
- One-Time Inspection Program

These AMPs are credited for managing the aging effects of components in several structures and systems and, therefore, are considered common AMPs. The staff has evaluated these common AMPs and has found them to be acceptable for managing the aging effects identified for this system. These AMPs are evaluated in Sections 3.0.3.2, 3.0.3.7, 3.0.3.10, 3.0.3.12, and 3.0.3.13 of this SER.

For the SFPC heat exchangers, the applicant has elected to use the chemistry program and the cooling water corrosion program, as indicated by LRA Table 2.3.3.2-1 link to items 3.2.1.09 and 3.3.3.01. During the AMR inspection and audit, the staff verified that the inspections of the heat exchanger that are performed under the cooling water corrosion program cover both the cooling water side and the spent fuel pool side of the heat exchanger. The staff concludes that the inspections can verify the effectiveness of the chemistry program for the spent fuel pool (SFP) side of the heat exchanger; therefore, the staff finds this acceptable.

For the piping, fittings, and other stainless steel components in the spent fuel pool cooling system exposed to borated treated water, the applicant's December 12, 2002, response to RAI 3.3-1 clarified that the aging management is through link 3.3.3-01. This link addresses SCC of stainless steel in borated treated water, and uses the chemistry program with no backup inspections based on the GALL recommendations for ECCS systems with similar materials and environments.

The staff finds this acceptable as discussed in Section 3.3.2.2.1 of this SER.

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with SFPC. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR54.21(d)

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of material due to general, pitting, and crevice corrosion for components in the SFPC.

3.3.2.4.2.3 Conclusions

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and has adequate AMPs for managing the aging effects, for components in SFPC, such that the component intended functions will be maintained consistent with the CLB for the period of extended operation to satisfy 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR Supplement program descriptions and concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in the SPFC to satisfy 10 CFR 54.21(d).

3.3.2.4.3 Emergency Diesel Generators

3.3.2.4.3.1 Summary of Technical Information in the Application

The description of the emergency diesel generators (EDGs) can be found in Section 2.3.3.3 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.3.3-1. In addition, the applicant also added component type "mechanical function unit," which refers to the hinged cap on the end of the diesel generator exhaust piping. The components, aging effects, and AMPs are provided in LRA Tables 3.3-1, 3.3-2, and 3.3-3.

Aging Effects

Table 2.3.3.3-1 of the LRA lists individual system components that are within the scope of license renewal and subject to an AMR. The components include bolting, pipes, and fittings.

The LRA stated that carbon steel in air is subject to loss of material due to general external corrosion. The LRA also identifies that galvanized steel in exhaust is subject to cracking due to embrittlement at high temperatures, loss of material due to crevice corrosion caused by aggressive chemical species and moisture, and pitting due to halides, chlorides, and hypochlorites. Stainless steel in exhaust is subject to cracking due to moisture containing concentrated contaminants, which produce an environment conducive to SCC and IGA, loss of material due to crevice corrosion from aggressive chemical species, and pitting due to halides, chlorides, and hypochlorites. The LRA does not identify any aging effects for stainless steel in air.

Aging Management Programs

The following AMPs are utilized to manage aging effects in the EDGs:

- Periodic Surveillance and Preventive Maintenance Program (B.2.7)
- General Corrosion of External Surfaces Program (B.3.3)
- Selective Leaching Program (B.3.6)

A description of these AMPs is provided in Appendix B of the LRA.

3.3.2.4.3.2 Staff Evaluation

Aging Effects

The staff reviewed the information in LRA Tables 2.3.3.3-1, 3.3-1, 3.3-2, and 3.3-3 for the EDGs, as well as the applicant's responses to the staff's RAIs.

By letter dated October 11, 2002, the staff issued RAI 3.3-2 pertaining to descriptions of the internal and external environments included in the LRA. The staff's evaluation of the applicant's response is documented in Section 3.3.2.5.1 of this SER and is characterized as resolved.

On the basis of its review of LRA Tables 2.3.3.3-1, 3.3-1, 3.3-2, and 3.3-3, and the information included in the applicant's responses to the staff's RAIs, the staff finds that the aging effects identified for the EDG components are consistent with industry experience for these combinations of materials and environments. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the EDGs.

Aging Management Programs

The applicant credited the following AMPs for managing the aging effects in the EDGs:

- Periodic Surveillance and Preventive Maintenance Program (3.0.3.10)
- General Corrosion of External Surfaces Program (3.0.3.12)
- Selective Leaching Program (3.0.3.14)

These AMPs are credited for managing the aging effects of components in several structures and systems and, therefore, are considered common AMPs. The staff has evaluated these common AMPs and has found them to be acceptable for managing the aging effects identified for this system. These AMPs are evaluated in Sections 3.0.3.10, 3.0.3.12, and 3.0.3.14 of this SER.

Based on its review of the information provided in the LRA, the staff concludes that the above identified AMPs will effectively manage the aging effects of the EDGs.

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with the EDGs. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

3.3.2.4.3.3 Conclusions

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and has adequate AMPs for managing the aging effects, for EDG components, such that the component 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 USAR Supplement program descriptions and concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in the EDG system to satisfy 10 CFR 54.21(d).

3.3.2.4.4 <u>Diesel Generator Lube Oil and Fuel Oil</u>

The description of the EDG lube oil and fuel oil (DGLO and DGFO) system can be found in Section 2.3.3.4 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.3.4-1. The components, aging effects, and AMPs are provided in LRA Tables 3.3-1, 3.3-2, and 3.3-3.

3.3.2.4.4.1 Summary of Technical Information in the Application

Table 2.3.3.4-1 of the LRA lists individual system components that are within the scope of license renewal and subject to an AMR. The components include bolting, filters/strainers, flow element/orifice, heat exchanger, hose, hose coupling, indicator (sight glass), pipes and fittings, pump casings, tanks, tubing, and valve bodies.

Aging Effects

Carbon steel, galvanized steel, cadmium-plated steel, cast iron, and copper in air are identified as being subject to loss of material due to general, pitting, and crevice corrosion, and MIC. Stainless steel, carbon steel, galvanized steel, coated carbon steel, cast iron, brass and bronze in fuel oil (with possible water contamination) are subject to loss of material due to general, pitting, and crevice corrosion, and MIC. Carbon steel, cadmium-plated steel, copper alloy, brass, and bronze in lubricating oil (with possible water contamination) are subject to loss of material due to general, pitting, and crevice corrosion, and MIC. Brass and copper alloy in corrosion-inhibited treated water are subject to loss of material due to crevice and pitting corrosion, galvanic corrosion due to dissimilar metals and MIC, and cracking due to SCC. Copper alloy in corrosion-inhibited treated water is subject to selective leaching. No aging effects are identified for stainless steel, brass, bronze, copper alloy, or copper-zinc alloy in air.

Aging Management Programs

The following AMPs are utilized to manage aging effects in the DGLO and DGFO system:

- Chemistry Program (B.1.2)
- Cooling Water Corrosion Program (B.2.2)
- Diesel Fuel Monitoring and Storage Program (B.2.3)
- Periodic Surveillance and Preventive Maintenance Program (B.2.7)
- Buried Surface External Corrosion Program (B.3.2)
- General Corrosion of External Surfaces Program (B.3.3)
- Selective Leaching Program (B.3.6)

A description of these AMPs is provided in Appendix B of the LRA.

3.3.2.4.4.2 Staff Evaluation

Aging Effects

The staff reviewed the information in LRA Tables 2.3.3.4-1, 3.3-1, 3.3-2, and 3.3-3 for the DGLO and DGFO system. The staff also reviewed the applicant's responses to the staff's requests for additional information.

By letter dated October 11, 2002, the staff issued RAI 3.3-2 pertaining to the description of the internal and external environments included in the LRA. The staff's evaluation of the applicant's response is documented in Section 3.3.2.5.1 of this SER and is characterized as resolved.

On the basis of its review of the information provided in the LRA and the information included in the applicant's response to the staff's RAI, the staff finds that the aging effects identified for the DGLO and DGFO system components described in LRA Tables 2.3.3.4-1, 3.3-1, 3.3-2, and 3.3-3 are consistent with industry experience for these combinations of materials and environments. Therefore, the staff finds the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the DGLO and DGFO system.

Aging Management Programs

The applicant credited the following AMPs for managing the aging effects in the DGLO and DGFO system:

- Chemistry Program (3.0.3.2)
- Cooling Water Corrosion Program (3.0.3.7)
- Periodic Surveillance and Preventive Maintenance Program (3.0.3.10)
- General Corrosion of External Surfaces Program (3.0.3.12)
- Selective Leaching Program (3.0.3.14)
- Diesel Fuel Monitoring and Storage Program (3.3.2.3.1)
- Buried Surface External Corrosion Program (3.3.2.3.2)

With the exception of the diesel fuel monitoring and storage program and the buried surfaces external corrosion program, these AMPs are credited for managing the aging effects of components in several structures and systems and, therefore, are considered common AMPs. The staff has evaluated these common AMPs and found them to be acceptable for managing the aging effects identified for this system. These common AMPs are evaluated in Sections 3.0.3.2, 3.0.3.7, 3.0.3.10, 3.0.3.12, and 3.0.3.14, respectively, of this SER. The diesel fuel monitoring and storage program and the buried surfaces external corrosion program are evaluated in Sections 3.3.2.3.1 and 3.3.2.3.2 of this SER, respectively.

Based on its review of the information provided in the LRA, the staff concludes that the above identified AMPs will effectively manage the aging effects of the DGLO and DGFO system.

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with the DGLO and DGFO system. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

3.3.2.4.4.3 Conclusions

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and has adequate AMPs for managing the aging effects, for components in the DGLO and DGFO system, such that the component 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 USAR Supplement program descriptions and concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in the DGLO amd DGFO system to satisfy 10 CFR 54.21(d).

3.3.2.4.5 Auxiliary Boiler Fuel Oil and Fire Protection Fuel Oil

The description of the auxiliary boiler fuel oil and fire protection fuel oil system can be found in Section 2.3.3.5 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.3.5-1. The components, aging effects, and AMPs are provided in LRA Tables 3.3-1, 3.3-2, and 3.3-3.

3.3.2.4.5.1 Summary of Technical Information in the Application

Table 2.3.3.5-1 of the LRA lists individual system components that are within the scope of license renewal and subject to an AMR. The components include bolting, filters/strainers, hose, hose coupling, indicator (sight glass), pipes and fittings, pump casings, tanks, tubing, and valve bodies.

Aging Effects

Carbon steel, cadmium-plated steel, galvanized steel, and cast iron in air (ambient) are identified as being subject to loss of material due to general, pitting, and crevice corrosion, and/or MIC. Stainless steel, carbon steel, galvanized steel, coated carbon steel, cast iron, aluminum, brass, bronze, and copper-zinc alloy in fuel oil (with potential water contamination) are subject to loss of material due to general, pitting, galvanic, and crevice corrosion, MIC, and biofouling. Buried carbon steel is subject to loss of material due to general, pitting, and crevice corrosion, and MIC; and copper-zinc alloy in a buried environment is subject to loss of material due to general and pitting corrosion, and selective leaching (dezincification). Carbon steel, galvanized steel, and copper-zinc alloy above ground and buried in gravel (and protected from the elements) are subject to loss of material due to general and/or pitting corrosion. No aging effects are identified for stainless steel, aluminum, brass, bronze, copper alloy, or copper-zinc alloy in air (ambient or instrument air), or glass in fuel oil.

Aging Management Programs

The following AMPs are utilized to manage aging effects in the auxiliary boiler fuel oil and fire protection fuel oil system:

- Diesel Fuel Monitoring and Storage Program (B.2.3)
- Fire Protection Program (B.2.5)
- Periodic Surveillance and Preventive Maintenance Program (B.2.7)
- Buried Surface External Corrosion Program (B.3.2)
- General Corrosion of External Surfaces Program (B.3.3)
- Selective Leaching Program (B.3.6)

A description of these AMPs is provided in Appendix B of the LRA.

3.3.2.4.5.2 Staff Evaluation

Aging Effects

The staff reviewed the information in LRA Tables 2.3.3.5-1, 3.3-1, 3.3-2, and 3.3-3 for the auxiliary boiler fuel oil and fire protection fuel oil system. The staff also reviewed the applicant's responses to the staff's RAIs. The applicant considers that the fuel oil is potentially contaminated with water, and the applicant has identified the appropriate aging effects for this condition.

By letter dated October 11, 2002, the staff issued RAI 3.3-2 pertaining to the description of the internal and external environments included in the LRA. The staff's evaluation of the applicant's response is documented in Section 3.3.2.5.1 of this SER and is characterized as resolved.

On the basis of its review of the information provided in LRA and the information included in the applicant's responses to the staff's RAI, the staff finds that the aging effects identified for the auxiliary boiler fuel oil and fire protection fuel oil system components described in LRA Tables 2.3.3.5-1, 3.3-1, 3.3-2, and 3.3-3 are consistent with industry experience for these combinations of materials and environments. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the auxiliary boiler fuel oil and fire protection fuel oil system.

Aging Management Programs

The applicant credited the following AMPs for managing the aging effects in the auxiliary boiler fuel oil and fire protection fuel oil system:

- Fire Protection Program (3.0.3.9)
- Periodic Surveillance and Preventive Maintenance Program (3.0.3.10)

- General Corrosion of External Surfaces Program (3.0.3.12)
- Selective Leaching Program (3.0.3.14)
- Diesel Fuel Monitoring and Storage Program (3.3.2.3.1)
- Buried Surfaces External Corrosion Program (3.3.2.3.2)

With the exception of the diesel fuel monitoring and storage program and the buried surfaces external corrosion program, these AMPs are credited with managing the aging effects of components in several structures and systems and, therefore, are considered common AMPs. The staff has evaluated these common AMPs and found them to be acceptable for managing the aging effects identified for this system. These common AMPs are evaluated in Sections 3.0.3.9, 3.0.3.10, 3.0.3.12, and 3.0.3.14, respectively, of this SER. The diesel fuel monitoring and storage program and the buried surfaces external corrosion program have been evaluated and found to be appropriate for this system. The diesel fuel monitoring and storage program and the buried surfaces external corrosion program are discussed in Sections 3.3.2.3.1 and 3.3.2.3.2 of this SER, respectively.

The staff asked several RAIs related to how the diesel fuel monitoring and storage program would manage the fire protection fuel oil storage tank and its associated piping and fittings. RAI 3.3.2-3 asked how the program, which focuses on internal oil environments, would be used to monitor for the external corrosion of the components. RAI B.2.3-1 asked for information related to the applicant's intention to use leakage detection to manage aging of the components. In its December 19, 2002, response to these RAIs, the applicant confirmed its intention to rely on leakage detection to monitor for internal and external corrosion of the fire protection diesel fuel tank and the associated piping, and provided information related to other testing and oil sampling that would be performed. In response to the staff's concerns with the use of leakage detection, by letter dated March 14, 2003, the applicant has stated that a one-time inspection will be used to evaluate the condition of the tank. This issue is discussed in Section 3.3.2.3.1.2 of this SER.

On the basis of its review of the information provided in the LRA and the information included in the applicant's responses to the staff's requests for additional information, the staff concludes that the above identified AMPs will effectively manage the aging effects of the auxiliary boiler fuel oil and fire protection fuel oil system.

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with the auxiliary boiler fuel oil and fire protection fuel oil system. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

3.3.2.4.5.3 Conclusions

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and has adequate AMPs for managing the aging effects, for components in the auxiliary boiler fuel oil and fire protection fuel oil system, such that the component 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 USAR Supplement program descriptions and concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in the auxiliary boiler fuel oil and fire protection fuel oil system to satisfy 10 CFR 54.21(d).

3.3.2.4.6 Diesel Jacket Water

3.3.2.4.6.1 Summary of Technical Information in the Application

The description of the EDG jacket water system can be found in Section 2.3.3.6 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.3.6-1. The components, aging effects, and AMPs are provided in LRA Tables 3.3-1, 3.3-2, and 3.3-3.

Aging Effects

Table 2.3.3.6-1 of the LRA lists individual system components that are within the scope of license renewal and subject to an AMR. The components include bolting, electric heaters (sleeves), heat exchangers (radiators), indicators (sightglasses), pipes and fittings, pump casings, tanks, and valve bodies.

The LRA stated that carbon steel, cast iron, galvanized steel, and cadmium-plated steel in air are subjected to loss of material due to general external corrosion. The LRA also stated that stainless steel, carbon steel, cast iron, brass/copper alloy, and copper alloy in corrosion-inhibited treated water are subject to loss of material due to such mechanisms as general, pitting, galvanic, and crevice corrosion, MIC, and/or selective leaching. Stainless steel and brass/copper alloy in corrosion-inhibited treated water are subject to cracking due to SCC. The LRA did not identify any aging effects for stainless steel, brass, or copper alloy in air, or for glass in oil, air, or corrosion-inhibited treated water.

Aging Management Programs

The following AMPs are utilized to manage aging effects in the EDG jacket water system:

- Chemistry Program (B.1.2)
- Cooling Water Corrosion Program (B.2.2)
- Periodic Surveillance and Preventive Maintenance Program (B.2.7)
- General Corrosion of External Surfaces Program (B.3.3)
- Selective Leaching Program (B.3.6)

A description of these AMPs is provided in Appendix B of the LRA.

3.3.2.4.6.2 Staff Evaluation

Aging Effects

The staff reviewed the information in LRA Tables 2.3.3.6-1, 3.3-1, 3.3-2, and 3.3-3 for the EDG jacket water system, as well as the applicant’s responses to the staff’s RAI.

By letter dated October 11, 2002, the staff issued RAI 3.3-2 pertaining to the description of the internal and external environments included in the LRA. The staff’s evaluation of the applicant’s response is documented in Section 3.3.2.5.1 of this SER and is characterized as resolved.

In RAI 3.3.3-4, the staff asked for clarification of the temperature of the heater elements, since the LRA's AMR cites a GALL item that has an inherent temperature limit. The applicant's December 19, 2002, RAI response did not fully answer questions of operating temperature; however, the staff notes that the applicant relies on the chemistry program and the cooling water corrosion program for aging management of the heaters. These programs collectively implement the recommendations in EPRI TR-107396 for this system. This aging management is consistent with the GALL recommendations for other components that do not have restrictive temperature limits; therefore, the staff finds the aging management to be acceptable and considers RAI 3.3.3-4 resolved.

On the basis of its review of LRA Tables 2.3.3.6-1, 3.3-1, 3.3-2, and 3.3-3, and the applicant's responses to the RAIs, the staff finds that the aging effects identified for the EDG jacket water system components are consistent with industry experience for these combinations of materials and environments. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the EDG jacket water system.

Aging Management Programs

The applicant credited the following AMPs for managing the aging effects in the EDG jacket water system:

- Chemistry Program (3.0.3.2)
- Cooling Water Corrosion Program (3.0.3.7)
- Periodic Surveillance and Preventive Maintenance Program (3.0.3.10)
- General Corrosion of External Surfaces Program (3.0.3.12)
- Selective Leaching Program (3.0.3.14)

These AMPs are credited with managing the aging effects of components in several structures and systems and, therefore, are considered common AMPs. The staff has evaluated these common AMPs and has found them to be acceptable for managing the aging effects identified for this system. These AMPs are evaluated in Sections 3.0.3.2, 3.0.3.7, 3.0.3.10, 3.0.3.12, and 3.0.3.14, respectively, of this SER.

On the basis of its review of the information provided in the LRA, the staff concludes that the above identified AMPs will effectively manage the aging effects of the EDG jacket water system.

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with the diesel jacket water system. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

3.3.2.4.6.3 Conclusions

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and has adequate AMPs for managing the aging effects, for components in the EDG jacket water system, such that the component 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 USAR Supplement program descriptions and concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in the EDG jacket water system to satisfy 10 CFR 54.21(d).

3.3.2.4.7 Diesel Starting Air

3.3.2.4.7.1 Summary of Technical Information in the Application

The description of the diesel starting air system can be found in Section 2.3.3.7 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.3.7-1. The components, aging effects, and AMPs are provided in LRA Tables 3.3-1, 3.3-2, and 3.3-3.

Aging Effects

Components of the diesel starting air system are described in LRA Section 2.3.3.7 as being within the scope of license renewal, and subject to an AMR. LRA Table 2.3.3.7-1 lists individual components of the system including bolting, filters/strainers, heat exchangers, lubricator body, air motor casings, pipes and fittings, tanks, and valve bodies. Carbon steel components are identified as being subject to loss of material due to general, pitting, and crevice corrosion, and MIC from exposure to ambient (warm, moist) air and have no aging effects from exposure to gas/instrument air. Exposure of stainless steel components to ambient air or gas/instrument air has no aging effects. Exposure of brass, bronze, copper, copper alloy, and copper-zinc alloy components to ambient air or gas/instrument air has no aging effects. Cast iron, cadmium-plated steel and galvanized steel components are identified as being subject to loss of material due to general, pitting, and crevice corrosion, and MIC from exposure to ambient (warm, moist) air.

Aging Management Programs

The general corrosion of external surfaces program (B.3.3) is utilized to manage aging effects in the diesel starting air system.

A description of this AMP is provided in Appendix B of the LRA.

3.3.2.4.7.2 Staff Evaluation

Aging Effects

The staff reviewed the information in LRA Tables 2.3.3.7-1, 3.3-1, 3.3-2, and 3.3-3 for the diesel starting air system. During its review, the staff determined that additional information was needed to complete its review.

By letter dated October 11, 2002, the staff issued RAI 3.3-2 pertaining to the descriptions of the internal and external environments included in the LRA. The staff's evaluation of the applicant's response is documented in Section 3.3.2.3.5.1 of this SER and is characterized as resolved.

By letter dated October 11, 2002, the staff issued RAI 3.3.1-2 pertaining to aging effects for components that are exposed to an instrument air (IA) environment. The staff's evaluation of the applicant’s response is documented in Section 3.3.2.4.8.2 of this SER and is characterized as resolved.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant’s response to the above RAIs, the staff finds that the aging effects that result from contact of the diesel starting air system SSCs to the environments described in LRA Tables 2.3.3.7-1, 3.3-1, 3.3-2, and 3.3-3 are consistent with industry experience for these combinations of materials and environments. Therefore, the staff finds the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the diesel starting air system.

Aging Management Program

The applicant credited the general corrosion of external surfaces program (3.0.3.12) for managing the aging effects in the diesel starting air system

This AMP is credited for managing the aging effects of several components in other structures and systems and is, therefore, considered a common AMP. The staff has evaluated this common AMP and found it to be acceptable for managing the aging effects identified for this system. The staff's evaluation of this AMP is documented in Section 3.0.3.12 of this SER.

On the basis of its review of the information provided in the LRA, the staff concludes that the above identified AMP will effectively manage the aging effects of the diesel starting air system.

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with the diesel starting air system. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

3.3.2.4.7.3 Conclusions

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and AMPs credited for managing the aging effects, for components in the diesel starting air system, such that the component 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 USAR Supplement program descriptions and concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in the diesel starting air system to satisfy 10 CFR 54.21(d).

3.3.2.4.8. Instrument Air

3.3.2.4.8.1 Summary of Technical Information in the Application

The description of the IA system can be found in Section 2.3.3.8 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.3.8-1. The components, aging effects, and aging management programs are provided in LRA Tables 3.3-1, 3.3-2, and 3.3-3.

Aging Effects

Components of the IA system are described in LRA Section 2.3.3.8 as being within the scope of license renewal, and subject to an AMR. LRA Table 2.3.3.8-1 lists individual components of the system, including accumulators, bolting, filter housing, pipes and fittings, tubing, valve body, and valve operator bodies. Carbon steel components are identified as being subject to loss of material due to general, pitting, and crevice corrosion, and MIC from exposure to ambient (warm, moist) air and have no aging effects from exposure to gas/instrument air. Exposure of stainless steel components to ambient air, gas/instrument air or gas/nitrogen air has no aging effects. Exposure of aluminum, brass, bronze, copper, copper alloy, and copper-zinc alloy components to ambient air, gas/instrument air or gas/nitrogen air has no aging effects. Closure bolting and external surfaces of carbon steel and low-alloy steel components are identified as being subject to loss of material due to boric acid corrosion from exposure to borated water leaking from adjacent systems or components containing borated treated water.

Aging Management Programs

The following AMPs are utilized to manage aging effects in the IA system:

- Boric Acid Corrosion Prevention Program (B.2.1)
- General Corrosion of External Surfaces Program (B.3.3)

A description of these AMPs is provided in Appendix B of the LRA.

3.3.2.4.8.2 Staff Evaluation

Aging Effects

The staff reviewed the information in LRA Tables 2.3.3.8-1, 3.3-1, 3.3-2, and 3.3-3 for the IA system. During its review, the staff determined that additional information was needed to complete its review.

Numerous components included in LRA Tables 2.3.3.7-1 and 2.3.3.8-1 referred to LRA Table 3.3-2, row number 3.3.2.23, for the AMR results. These components are made of carbon steel and are exposed to the internal environment of IA. The LRA states that there are no aging effects that require management for this material/environment combination. Similarly, in LRA Table 3.3-1, row number 3.3.1.18, the applicant stated that the components in the IA system at FCS are exposed to dry air, and that the environment (wet air/gas) identified in the GALL Report is not applicable to FCS. It should be noted that in the IA system, components that are located upstream of the air dryers are generally exposed to a wet air/gas environment and, therefore, may be subject to loss of material due to general and pitting corrosion. In addition, it is reasonable to assume that components downstream of the dryers are exposed to dry air/gas environment. However, this may not be supported by some operating experience. For example, NRC IN 87-28, "Air Systems Problems at U.S. Light Water Reactors," provides that "A loss of decay heat removal and significant primary system heat up at Palisades in 1978 and 1981 were caused by water in the air system." This experience implies that the air/gas system downstream of the dryer may not be dry. By letter dated October 11, 2002, in RAI 3.3.1-2, the staff requested the applicant to discuss its plant-specific operating experience related to components that are exposed to an instrument air environment, and to provide a technical basis for not identifying loss of material as an aging effect for these components.

In its response dated December 19, 2002, the applicant stated that the IA system boundary does not include components upstream of the dryers. Those components are part of the compressed air system. The industry operating experience is varied because of the differences in system design and air dryer types in use. For stations with refrigerant dryers, the dewpoint of the air system is typically in the range of +30 °F to +40 °F. While this does prevent water accumulation in the system, it still provides sufficient moisture to allow corrosion. Also, for systems with a single air dryer, wet air can be pumped into the system in the event of a failure of the air dryer. Additionally, if the system dewpoint is not monitored, that condition can go undetected for a significant length of time, which can cause corrosion to occur.

The applicant also stated that the FCS operating experience has not shown that a wet environment exists downstream of the air dryers. The reasons for that are threefold. First, FCS has always used desiccant-type air dryers, which reduce the dewpoint of the instrument air to <-40 °F. This low level of moisture has been shown to preclude the corrosion mechanisms responsible for loss of material that occur in wet systems. Second, FCS has redundant air dryers installed. Lastly, the dewpoint of the instrument air is monitored with a sensor which alarms in the control room in the event the dewpoint exceeds -25 °F. No significant corrosion occurs in iron, zinc, copper, aluminum, or their alloys at relative humidities below 60%. The relative humidity of the instrument air at a dewpoint of -25 °F is less than 2%. In addition, the applicant stated that the operating experience review for FCS did identify a single water intrusion event that introduced water into the IA system from the fire protection system due to a crosstie between the two systems downstream of the air dryers. This was a one time event of short duration, however, and not the normal operating environment. The crosstie was eliminated and the IA system was cleaned and dried following that event. Since the modification there has been no incidence of high moisture in the IA system.

On the basis of its review, the staff finds the applicant's response adequate and acceptable because the applicant has demonstrated that the IA system, including the air dryer design, will ensure that loss of material is not an applicable aging effect for the components that are exposed to an instrument air environment, which is validated by the plant operating experience.

By letter dated October 11, 2002, the staff issued RAI 3.3-2 pertaining to the description of the internal and external environments included in the LRA. The staff's evaluation of the applicant's response is documented in Section 3.3.2.5.1 of this SER and is resolved.

In LRA Table 2.3.3.8-1, the applicant identified a link to LRA AMR Item 3.3.1.07 for the accumulators. During the AMR inspection and audit, the applicant clarified that link 3.3.1.07 should be 3.3.1.05. The staff finds that the revised link (3.3.1.05) is appropriate for the accumulators. By letter dated February 20, 2003, the staff issued POI-10(c), requesting the applicant to provide this information formally. By letter dated March 14, 2003, the applicant provided the requested information. POI-10(c) is resolved.

On the basis of its review of the information provided in the LRA, and the additional information included in the applicant's response to the above RAIs and POI, the staff finds that the aging effects that result from contact of the IA system to the environments described in LRA Tables 2.3.3.8-1, 3.3-1, 3.3-2, and 3.3-3 are consistent with industry experience for these combinations of materials and environments. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the IA system.

Aging Management Programs

The applicant credited the following AMPs for managing the aging effects in the IA system:

- Boric Acid Corrosion Prevention Program (3.0.3.6)
- General Corrosion of External Surfaces Program (3.0.3.12)

The boric acid corrosion prevention program and the general corrosion of external surfaces program are credited for managing the aging effects of several components in other systems and are, therefore, considered common AMPs. The staff has evaluated these common AMPs and found them to be acceptable for managing the aging effects identified for this system. The staff's evaluation of these AMPs is documented in Sections 3.0.3.6 and 3.0.3.12 of this SER, respectively.

On the basis of its review of the information provided in the LRA, the staff concludes that the above identified AMPs will effectively manage the aging effects of the IA system.

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with the IA system. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

3.3.2.4.8.3 Conclusions

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and AMPs credited for managing the aging effects, for components in the instrument air system, such that the component 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 USAR Supplement program descriptions and concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in the instrument air system to satisfy 10 CFR 54.21(d).

3.3.2.4.9 <u>Nitrogen Gas</u>

3.3.2.4.9.1 Summary of Technical Information in the Application

The description of the nitrogen gas (NG) system can be found in Section 2.3.3.9 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.3.9-1. The components, aging effects, and AMPs are provided in LRA Tables 3.3-1, 3.3-2, and 3.3-3.

Aging Effects

Components of the NG system are described in LRA Section 2.3.3.9 of the submittal as being within the scope of license renewal, and subject to an AMR. LRA Table 2.3.3.9-1 lists individual components of the system including bolting, pipes and fittings, and valve bodies. Carbon steel components are identified as being subject to loss of material due to general, pitting, and crevice corrosion, and MIC from exposure to ambient (warm, moist) air and have no aging effects from exposure to gas/instrument air or gas/nitrogen air. Exposure of stainless steel, brass, and bronze components to ambient air or gas/nitrogen air has no aging effects. Closure bolting and external surfaces of carbon steel and low-alloy steel components are identified as being subject to loss of material due to boric acid corrosion from exposure to borated water leaking from adjacent systems or components containing borated treated water.

Aging Management Programs

The following AMPs are utilized to manage aging effects in the NG system:

- Boric Acid Corrosion Prevention Program (B.2.1)
- General Corrosion of External Surfaces Program (B.3.3)

A description of these AMPs is provided in Appendix B of the LRA.

3.3.2.4.9.2 Staff Evaluation

Aging Effects

The staff reviewed the information in LRA Tables 2.3.3.9-1, 3.3-1, 3.3-2, and 3.3-3 for the NG system. During its review, the staff determined that additional information was needed to complete its review.

By letter dated October 11, 2002, the staff issued RAI 3.3-2 pertaining to the descriptions of the internal and external environments included in the LRA. The staff's evaluation of the applicant's response is documented in Section 3.3.2.5.1 of this SER and is characterized as resolved.

On the basis of its review of the information provided in the LRA, and the additional information included in the applicant's response to the above RAI, the staff finds that the aging effects that result from contact of the NG system to the environments described in LRA Tables 2.3.3.9-1, 3.3-1, 3.3-2, and 3.3-3 are consistent with industry experience for these combinations of materials and environments. Therefore, the staff finds the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the NG system.

Aging Management Programs

The applicant credited the following AMPs for managing the aging effects in the NG system:

- Boric Acid Corrosion Prevention Program (3.0.3.6)
- General Corrosion of External Surfaces Program (3.0.3.12)

These AMPs are credited for managing the aging effects of several components in other structures and systems and are, therefore, considered common AMPs. The staff has evaluated these common AMPs and found them to be acceptable for managing the aging effects identified for this system. The staff's evaluation of these AMPs is documented in Sections 3.0.3.6 and 3.0.3.12 of this SER.

On the basis of its review of the information provided in the LRA, the staff concludes that the above identified AMPs will effectively manage the aging effects of the NG system.

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with the NG system. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

3.3.2.4.9.3 Conclusions

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and AMPs credited for managing the aging effects, for components in the nitrogen gas system, such that the component 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 USAR Supplement program descriptions and concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in the nitrogen gas system to satisfy 10 CFR 54.21(d).

3.3.2.4.10 Containment Ventilation

3.3.2.4.10.1 Summary of Technical Information in the Application

The description of the containment ventilation system can be found in Section 2.3.3.10 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.3.10-1. The components, aging effects, and AMPs are provided in LRA Tables 3.3-1, 3.3-2, and 3.3-3.

Aging Effects

Components of the containment ventilation system are described in LRA Section 2.3.3.10 as being within the scope of license renewal, and subject to an AMR. LRA Table 2.3.3.10-1 lists individual components of the system, including blowers and fan housing, bolting, filter housing, duct, dampers, heat exchangers, pipes and fittings, and valve bodies. Carbon steel, cast iron, cadmium-plated steel, and galvanized steel components are identified as being subject to loss of material due to general, pitting, and crevice corrosion, and MIC from exposure to ambient (warm, moist) air. Exposure of stainless steel, brass, and bronze components to ambient air has no aging effects. Closure bolting, including galvanized steel bolting material, and external surfaces of carbon steel, low-alloy steel, cast iron, cadmium-plated steel, galvanized steel, and copper alloy components are identified as being subject to loss of material due to boric acid corrosion from exposure to borated water leaking from adjacent systems or components containing borated treated water. Brass, copper, and copper alloy components are identified as being subject to cracking and loss of material due to crevice, pitting, and galvanic corrosion, selective leaching, and MIC, from exposure to corrosion-inhibited treated water. Elastomer seals are identified as being subject to hardening, cracking, and loss of strength due to elastomer degradation and loss of material due to wear from exposure to ambient (warm, moist) air.

Aging Management Programs

The following AMPs are utilized to manage aging effects in the containment ventilation system:

- Chemistry Program (B.1.2)
- Boric Acid Corrosion Prevention Program (B.2.1)

- Cooling Water Corrosion Program (B.2.2)
- Periodic Surveillance and Preventive Maintenance Program (B.2.7)
- General Corrosion of External Surfaces Program (B.3.3)
- Selective Leaching Program (B.3.6)

A description of these AMPs is provided in Appendix B of the LRA.

3.3.2.4.10.2 Staff Evaluation

Aging Effects

The staff reviewed the information in LRA Tables 2.3.3.10-1, 3.3-1, 3.3-2, and 3.3-3 for the containment ventilation system. During its review, the staff determined that additional information was needed to complete its review.

In LRA Table 2.3.3.10-1, the applicant identified two intended functions - heat transfer and pressure boundary - for the heat exchanger, and referred to LRA Tables 3.3-1, 3.3-2, and 3.3-3 (rows 3.3.1.05, 3.3.2.01, 3.3.2.10, 3.3.2.17, 3.3.2.39, 3.3.2.84, and 3.3.3.09) for the AMR results for the heat exchanger. In LRA Table 3.3-2, row 3.3.2.39, the applicant identified loss of material as the applicable aging effect and credited the chemistry program and cooling water corrosion program for managing the aging effect. However, the staff notes that fouling is another aging effect that will result in a loss of the heat transfer function. By letter dated October 11, 2002, in RAI 3.3.2-4, the staff requested the applicant to provide a technical basis for not identifying fouling as an applicable aging effect for the heat exchanger, or to provide a program to manage fouling in the heat exchanger.

In its response dated December 19, 2002, the applicant stated that fouling has not been identified as an AERM because the cooling medium for these coolers is CCW. For these containment ventilation coils, FCS operating experience has shown that fouling does not occur. Consistent with the GALL Report, fouling is only applicable as an AERM for heat exchangers when an open-cycle cooling water system is used. The only open-cycle cooling water heat exchangers at FCS are the CCW/RW heat exchangers. Visual inspections for fouling of the CCW/RW heat exchangers is currently performed every 18 months, and heat transfer performance verified every six months. The applicant further stated that the exception noted in FCS' cooling water corrosion program (B.2.2) is for fluid flow and not for the heat transfer function. Heat transfer performance testing on applicable heat exchangers is performed per OPPD's response to GL 89-13. Therefore, despite no evidence of fouling, it will monitor for fouling as part of the FCS' cooling water corrosion program.

On the basis of its review, the staff finds that the applicant's response is reasonable and acceptable because heat transfer performance testing on applicable heat exchangers is performed per OPPD's response to GL 89-13 and the FCS' cooling water corrosion program and will adequately monitor for fouling of the heat exchanger in the containment ventilation system.

By letter dated October 11, 2002, the staff issued RAI 3.3-2 pertaining to the description of the internal and external environments included in the LRA. The staff's evaluation of the applicant's response is documented in Section 3.3.2.5.1 of this SER and is characterized as resolved.

By letter dated October 11, 2002, the staff issued RAI 3.3.1-1 pertaining to aging effects for elastomer components in ventilation systems. The staff's evaluation of the applicant's response is documented in Section 3.3.2.5.2 of this SER and is characterized as resolved.

By letter dated October 11, 2002, the staff issued RAI 3.3.3-1 pertaining to aging effects of boric acid corrosion of components in air exposed to leaking and dripping borated treated water. The staff's evaluation of the applicant's response is documented in Section 3.3.2.5.3 of this SER and is characterized as resolved.

On the basis of its review of the information provided in the LRA, and the additional information included in the applicant's response to the above RAIs, the staff finds that the aging effects that result from contact of the containment ventilation system to the environments described in LRA Tables 2.3.3.10-1, 3.3-1, 3.3-2, and 3.3-3 are consistent with industry experience for these combinations of materials and environments. Therefore, the staff finds the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the containment ventilation system.

Aging Management Programs

The applicant credited the following AMPs for managing the aging effects in the containment ventilation system:

- Chemistry Program (3.0.3.2)
- Boric Acid Corrosion Prevention Program (3.0.3.6)
- Cooling Water Corrosion Program (3.0.3.7)
- Periodic Surveillance and Preventive Maintenance Program (3.0.3.10)
- General Corrosion of External Surfaces Program (3.0.3.12)
- Selective Leaching Program (3.0.3.14)

These AMPs are credited for managing the aging effects of several components in other structures and systems and are, therefore, considered common AMPs. The staff has evaluated these common AMPs and found them to be acceptable for managing the aging effects identified for this system. The staff's evaluation of these AMPs is documented in Sections 3.0.3.2, 3.0.3.6, 3.0.3.7, 3.0.3.10, 3.0.3.12, and 3.0.3.14, respectively, of this SER.

Based on its review of the information provided in the LRA, the staff concludes that the above identified AMPs will effectively manage the aging effects of the containment ventilation system.

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with the containment ventilation system. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

3.3.2.4.10.3 Conclusions

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and AMPs credited for managing the aging effects, for components in the containment ventilation system, such that the component 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 USAR Supplement program descriptions and concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in the containment ventilation system to satisfy 10 CFR 54.21(d).

3.3.2.4.11 Auxiliary Building Ventilation

3.3.2.4.11.1 Summary of Technical Information in the Application

The description of the auxiliary building ventilation system can be found in Section 2.3.3.11 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.3.11-1. The components, aging effects, and AMPs are provided in LRA Tables 3.3-1, 3.3-2, and 3.3-3.

Aging Effects

Components of the auxiliary building ventilation system are described in LRA Section 2.3.3.11 as being within the scope of license renewal, and subject to an AMR. LRA Table 2.3.3.11-1 lists individual components of the system, including blowers and fan housing, bolting, filter/strainer housing, fire blocking damper, flow element housing, duct, dampers, pipes and fittings, and valve bodies. Carbon steel, cast iron, cadmium-plated steel, and galvanized steel components are identified as being subject to loss of material due to general, pitting, and crevice corrosion, and MIC, from exposure to ambient (warm, moist) air. Exposure of stainless steel and aluminum components to ambient air has no aging effects. Closure bolting, including galvanized steel bolting material, and external surfaces of carbon steel, low-alloy steel, cast iron, cadmium-plated steel, galvanized steel, and copper alloy components are identified as being subject to loss of material due to boric acid corrosion from exposure to borated water leaking from adjacent systems or components containing borated treated water. Elastomer seals are identified as being subject to hardening, cracking, and loss of strength due to elastomer degradation and loss of material due to wear from exposure to ambient (warm, moist) air.

Aging Management Programs

The following AMPs are utilized to manage aging effects in the auxiliary building ventilation system:

- Boric Acid Corrosion Prevention Program (B.2.1)
- Periodic Surveillance and Preventive Maintenance Program (B.2.7)
- General Corrosion of External Surfaces Program (B.3.3)

A description of these AMPs is provided in Appendix B of the LRA.

3.3.2.4.11.2 Staff Evaluation

Aging Effects

The staff reviewed the information in LRA Tables 2.3.3.11-1, 3.3-1, 3.3-2, and 3.3-3 for the auxiliary building ventilation system. During its review, the staff determined that additional information was needed to complete its review.

By letter dated October 11, 2002, the staff issued RAI 3.3-2 pertaining to the descriptions of the internal and external environments included in the LRA. The staff's evaluation of the applicant's response is documented in Section 3.3.2.5.1 of this SER and is resolved.

By letter dated October 11, 2002, the staff issued RAI 3.3.1-1 pertaining to aging effects for elastomer components in ventilation systems. The staff's evaluation of the applicant's response is documented in Section 3.3.2.5.2 of this SER and is resolved.

By letter dated October 11, 2002, the staff issued RAI 3.3.3-1 pertaining to aging effects of boric acid corrosion of components in air exposed to leaking and dripping borated treated water. The staff's evaluation of the applicant's response is documented in Section 3.3.2.5.3 of this SER and is resolved.

On the basis of its review of the information provided in the LRA and the additional information included in the applicant's response to the above RAIs, the staff finds that the aging effects that result from contact of the auxiliary building ventilation system to the environments described in LRA Tables 2.3.3.11-1, 3.3-1, 3.3-2, and 3.3-3 are consistent with industry experience for these combinations of materials and environments. Therefore, the staff finds the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the auxiliary building ventilation system.

Aging Management Programs

The applicant credited the following AMPs for managing the aging effects in the auxiliary building ventilation system:

- Boric Acid Corrosion Prevention Program (3.0.3.6)
- Periodic Surveillance and Preventive Maintenance Program (3.0.3.10)
- General Corrosion of External Surfaces Program (3.0.3.12)

These AMPs are credited for managing the aging effects of several components in other structures and systems and are, therefore, considered common AMPs. The staff has evaluated these common AMPs and found them to be acceptable for managing the aging effects identified for this system. The staff's evaluation of these AMPs is documented in Sections 3.0.3.6, 3.0.3.10, and 3.0.3.12 of this SER.

On the basis of its review of the information provided in the LRA, the staff concludes that the above identified AMPs will effectively manage the aging effects of the auxiliary building ventilation system.

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with the auxiliary building ventilation system. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

3.3.2.4.11.3 Conclusions

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and AMPs credited for managing the aging effects, for components in the auxiliary building ventilation system, such that the component 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 USAR Supplement program descriptions and concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in the auxiliary building ventilation system to satisfy 10 CFR 54.21(d).

3.3.2.4.12 Control Room HVAC and Toxic Gas Monitoring

3.3.2.4.12.1 Summary of Technical Information in the Application

The description of the control room HVAC and toxic gas monitoring system can be found in Section 2.3.3.12 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.3.12-1. The components, aging effects, and AMPs are provided in LRA Tables 3.3-1, 3.3-2, and 3.3-3.

Aging Effects

Components of the control room HVAC and toxic gas monitoring system are described in LRA Section 2.3.3.12 as being within the scope of license renewal, and subject to an AMR. LRA Table 2.3.3.12-1 lists individual components of the system, including blowers and fan housing, bolting, filter/strainer, fire blocking damper, duct, heat exchanger, pipes and fittings, and valve bodies. Carbon steel, cast iron, cadmium-plated steel, and galvanized steel components are identified as being subject to loss of material due to general, pitting, and crevice corrosion, and MIC from exposure to ambient (warm, moist) air. Exposure of stainless steel, aluminum, brass, bronze, copper, copper alloy, and copper zinc components to ambient air has no aging effects. Exposure of copper, copper alloy, brass, and cast iron components to gas/refrigerant has no aging effects. Brass, copper, and copper alloy components are identified as being subject to loss of material due to crevice, pitting, and galvanic corrosion, and MIC from exposure to corrosion-inhibited treated water. Cast iron components are identified as being subject to loss of material due to selective leaching and general, pitting, and crevice corrosion from exposure to corrosion-inhibited treated water. Carbon steel and stainless steel components are identified as being subject to loss of material due to general, pitting, and crevice corrosion, and MIC from exposure to corrosion-inhibited treated water. Elastomer seals are identified as being subject to hardening, cracking, and loss of strength due to elastomer degradation and loss of material due to wear from exposure to ambient (warm, moist) air.

Aging Management Programs

The following AMPs are utilized to manage aging effects in the control room HVAC and toxic gas monitoring system:

- Chemistry Program (B.1.2)
- Boric Acid Corrosion Prevention Program (B.2.1)
- Cooling Water Corrosion Program (B.2.2)
- Periodic Surveillance and Preventive Maintenance Program (B.2.7)
- General Corrosion of External Surfaces Program (B.3.3)
- Selective Leaching Program (B.3.6)

A description of these AMPs is provided in Appendix B of the LRA.

3.3.2.4.12.2 Staff Evaluation

Aging Effects

The staff reviewed the information in LRA Tables 2.3.3.12-1, 3.3-1, 3.3-2, and 3.3-3 for the control room HVAC and toxic gas monitoring system. During its review, the staff determined that additional information was needed to complete its review.

By letter dated October 11, 2002, the staff issued RAI 3.3-2 pertaining to the descriptions of the internal and external environments included in the LRA. The staff's evaluation of the applicant's response is documented in Section 3.3.2.5.1 of this SER and is characterized as resolved.

In LRA Table 2.3.3.12-1, the applicant identified two intended functions, heat transfer and pressure boundary for the heat exchanger, and referred to LRA Tables 3.3-1 and 3.3-2, rows 3.3.1.05, 3.3.2.29, 3.3.2.30, 3.3.2.39, 3.3.2.40, and 3.3.3.10, for the AMR results for the heat exchanger. In LRA Table 3.3-2, rows 3.3.2.29 and 3.3.2.39, the applicant identified loss of material as the applicable aging effect and credited the chemistry program and cooling water corrosion program for managing the aging effect. However, the staff notes that fouling is another aging effect that will result in a loss of the heat transfer function. The applicant was requested to provide a technical basis for not identifying fouling as an applicable aging effect for this heat exchanger, or provide a program to manage fouling in the heat exchanger. By letter dated October 11, 2002, in RAI 3.3.2-5, the staff requested the applicant to provide a technical basis for not identifying fouling as an applicable aging effect for the heat exchanger, or to provide a program to manage fouling in the heat exchanger.

In its response dated December 19, 2002, the applicant stated that fouling has not been identified as an AERM because the cooling medium for these coolers is CCW. For these containment ventilation coils, FCS operating experience has shown that fouling does not occur. Consistent with the GALL Report, fouling is only applicable as an AERM for heat exchangers when an open-cycle cooling water system is used. The only open-cycle cooling water heat exchangers at FCS are the CCW/RW heat exchangers. Visual inspections for fouling of the CCW/RW heat exchangers is currently performed every 18 months, and heat transfer performance verified every six months. The applicant further stated that the exception noted in FCS' cooling water corrosion program (B.2.2) is for fluid flow and not for the heat transfer function. Heat transfer performance testing on applicable heat exchangers is performed per OPPD's response to GL 89-13. Therefore, despite no evidence of fouling, it will monitor for fouling as part of the FCS' cooling water corrosion program.

On the basis of its review, the staff finds that the applicant's response is reasonable and acceptable because heat transfer performance testing on applicable heat exchangers is performed per OPPD's response to GL 89-13 and the FCS cooling water corrosion program, and will adequately monitor fouling for the heat exchanger in the control room HVAC and toxic gas monitoring system.

By letter dated October 11, 2002, the staff issued RAI 3.3.1-1 pertaining to aging effects for elastomer components in ventilation systems. The staff's evaluation of the applicant's response is documented in Section 3.3.2.5.2 of this SER and is characterized as resolved.

On the basis of its review of the information provided in the LRA, and the additional information included in the applicant's response to the above RAIs, the staff finds that the aging effects that result from contact of the control room HVAC and toxic gas monitoring system to the environments described in LRA Tables 2.3.3.12-1, 3.3-1, 3.3-2, and 3.3-3 are consistent with industry experience for these combinations of materials and environments. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the control room HVAC and toxic gas monitoring system.

Aging Management Programs

The applicant credited the following AMPs for managing the aging effects in the control room HVAC and toxic gas monitoring system:

- Chemistry Program (3.0.3.2)
- Boric Acid Corrosion Prevention Program (3.0.3.6)
- Cooling Water Corrosion Program (3.0.3.7)
- Periodic Surveillance and Preventive Maintenance Program (3.0.3.10)
- General Corrosion of External Surfaces Program (3.0.3.12)
- Selective Leaching Program (3.0.3.14)

These AMPs are credited for managing the aging effects of several components in other structures and systems and are, therefore, considered common AMPs. The staff has evaluated these common AMPs and found them to be acceptable for managing the aging effects identified for this system. The staff's evaluation of these AMPs is documented in Sections 3.0.3.2, 3.0.3.6, 3.0.3.7, 3.0.3.10, 3.0.3.12, and 3.0.3.14 of this SER.

On the basis of its review of the information provided in the LRA, the staff concludes that the above identified AMPs will effectively manage the aging effects of the control room HVAC and toxic gas monitoring system.

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with the control room HVAC and toxic gas monitoring system. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

3.3.2.4.12.3 Conclusions

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and AMPs credited for managing the aging effects, for components in the control room HVAC and toxic gas monitoring system, such that the component 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 USAR Supplement program descriptions and concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in the control room HVAC and toxic gas monitoring system to satisfy 10 CFR 54.21(d).

3.3.2.4.13 Ventilating Air

3.3.2.4.13.1 Summary of Technical Information in the Application

The description of the ventilating air system can be found in Section 2.3.3.13 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.3.13-1. The components, aging effects, and AMPs are provided in LRA Tables 3.3-1, 3.3-2, and 3.3-3.

Aging Effects

Components of the ventilating air system are described in Section 2.3.3.13 as being within the scope of license renewal, and subject to an AMR. LRA Table 2.3.3.13-1 lists individual components of the system, including bolting, damper housing, and ducts and fittings. Carbon steel components are identified as being subject to loss of material due to general, pitting, and crevice corrosion, and MIC from exposure to ambient (warm, moist) air.

Aging Management Programs

The following AMPs are utilized to manage aging effects in the ventilating air system:

- Periodic Surveillance and Preventive Maintenance Program (B.2.7)
- General Corrosion of External Surfaces Program (B.3.3)

A description of these AMPs is provided in Appendix B of the LRA.

3.3.2.4.13.2 Staff Evaluation

Aging Effects

The staff reviewed the information in LRA Tables 2.3.3.13-1, 3.3-1, 3.3-2, and 3.3-3 for the ventilating air system. During its review, the staff determined that additional information was needed to complete its review.

In LRA Table 2.3.3.13-1, the applicant identified loss of material as a plausible aging effect for ducts and fittings. The staff noted that for ducts in other ventilation systems, the applicant has also identified aging effects related to elastomer degradation. In order for the staff to understand whether aging effects are applicable to elastomers in the ducts for the ventilating air system, by letter dated October 11, 2002, in RAI 3.3.1-8, the staff requested the applicant to clarify whether there are elastomer components in the ventilating air system and to provide a technical basis for not considering aging degradation of the elastomer components, if any.

In its response dated December 12, 2002, the applicant stated that there are no elastomers in the ventilating air system; therefore, there are no aging effects requiring management. On the basis of its review, the staff finds the applicant's response acceptable because the information provided by the applicant clarifies that there are no elastomers in the ventilating air system.

By letter dated October 11, 2002, the staff issued RAI 3.3-2 pertaining to the descriptions of the internal and external environments included in the LRA. The staff's evaluation of the applicant's response is documented in Section 3.3.2.5.1 of this SER and is characterized as resolved.

On the basis of its review of the information provided in the LRA, and the additional information included in the applicant's response to the above RAIs, the staff finds that the aging effects that result from contact of the ventilating air system to the environments described in LRA Tables 2.3.3.13-1, 3.3-1, 3.3-2, and 3.3-3 are consistent with industry experience for these combinations of materials and environments. Therefore, the staff finds the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the ventilating air system.

Aging Management Programs

The applicant credited the following AMPs for managing the aging effects in the ventilating air system:

- Periodic Surveillance and Preventive Maintenance Program (3.0.3.10)
- General Corrosion of External Surfaces Program (3.0.3.12)

These AMPs are credited for managing the aging effects of several components in other structures and systems and are, therefore, considered common AMPs. The staff has evaluated these common AMPs and found them to be acceptable for managing the aging effects identified for this system. The staff's evaluation of these AMPs is documented in Sections 3.0.3.10 and 3.0.3.12 of this SER.

Based on its review of the information provided in the LRA, the staff concludes that the above identified AMPs will effectively manage the aging effects of the ventilating air system.

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with the ventilating air system. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

3.3.2.4.13.3 Conclusions

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and AMPs credited for managing the aging effects, for components in the ventilating air system, such that the component 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 USAR Supplement program descriptions and concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in the ventilating air system to satisfy 10 CFR 54.21(d).

3.3.2.4.14 Fire Protection

3.3.2.4.14.1 Summary of Technical Information in the Application

The description of the fire protection system can be found in Section 2.3.3.14 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.3.14-1. The components, aging effects, and AMPs are provided in LRA Tables 3.3-1, 3.3-2, and 3.3-3.

Aging Effects

LRA Table 2.3.3.14-1 lists individual system components that are within the scope of license renewal and subject to an AMR. The components include bolting, filters/strainers, flow element/orifice, fire protection sprinkler/spray nozzle, halon system nozzle, hose, hose cabinet, pipes and fittings, piping spray shield, pressure vessels, pump casings, switch/bistable housing, tank, and valve bodies.

The LRA identifies that carbon steel, galvanized steel, cast iron, and copper in air are subject to loss of material due to general external corrosion, and carbon steel and low alloy steel in dripping boric acid are subject to loss of material due to boric acid corrosion. The LRA also identifies that stainless steel, carbon steel, cast iron, and bronze in raw water are subject to loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling. Galvanized steel in raw water is subject to loss of material from general, pitting and crevice corrosion, MIC, and galvanic corrosion. Brass in raw water is subject to loss of material due to pitting and crevice corrosion, MIC, and galvanic corrosion. Aluminum in raw water is subject to loss of material due to crevice and pitting corrosion, and MIC. Copper in oil (in the RCP oil collection system) is subject to loss of material due to general, pitting, and crevice corrosion, and galvanic corrosion, and stainless steel in oil is subject to general corrosion due to contamination and pooling. Buried cast iron is subject to general corrosion and selective leaching. The LRA does not identify any aging effects for stainless steel, brass, bronze, copper, copper alloy, zinc alloy, or aluminum in air, coated carbon steel or brass in halon, or concrete in a raw water or buried environment.

Aging Management Programs

The following AMPs are utilized to manage aging effects in the fire protection system:

- Boric Acid Corrosion Prevention Program (B.2.1)
- Fire Protection Program (B.2.5)
- Periodic Surveillance and Preventive Maintenance Program (B.2.7)
- General Corrosion of External Surfaces Program (B.3.3)
- Selective Leaching Program (B.3.6)

A description of these AMPs is provided in Appendix B of the LRA.

3.3.2.4.14.2 Staff Evaluation

Aging Effects

The staff reviewed the information in LRA Tables 2.3.3.14-1, 3.3-1, 3.3-2, and 3.3-3 for the fire protection system. During its review, the staff determined that additional information was needed to complete its review of the fire protection system.

By letter dated October 11, 2002, the staff issued RAI 3.3-2 pertaining to the descriptions of the internal and external environments included in the LRA. The staff's evaluation of the applicant's response is documented in Section 3.3.2.5.1 of this SER and is characterized as resolved.

In RAI 2.3.3.14-2, sent by letter dated October 11, 2002, the staff questioned why various portions of the fire protection system were not included within the scope of license renewal. In its response dated December 19, 2002, the applicant added several components to the scope of the fire protection system. The addition of these components did not result in the addition of material/environment combinations or AMPs for the fire protection system. The staff's evaluation of the scope of the fire protection system is in Section 2.3.3.14 of this SER.

For buried concrete pipes and concrete pipes exposed to raw water piping, LRA Section 2.3.3.14 cites Items 3.3.2.34 and 3.3.2.35 in LRA Table 3.3-2 for aging management. Both of these items conclude that there are no AERMs. The staff believes that concrete exposed to raw water is potentially subjected to aging degradation and requires aging management. Similarly, buried concrete is subject to aging degradation, unless the soil environment is benign. By letter dated October 11, 2002, in RAI 3.3.2-6, the staff requested the applicant to provide justification for why concrete components in these environments do not have aging effects that require management, or provide a program to manage the aging for the buried concrete pipe carrying raw water for the fire protection system.

In its response dated December 19, 2002, the applicant stated that there is no flowing water around and within the pipe; therefore, change in material properties due to leaching of calcium hydroxide is not an applicable aging effect. The applicant's response further stated that the ground water and the river water (raw water) have been tested and found to be benign (sulfates < 1,500 ppm, chlorides < 500 ppm, and pH > 5.5); therefore, change of material properties and loss of material due to aggressive chemical attack are not applicable aging effects. Further, the applicant stated that the concrete pipe was recently inspected during a plant modification that required excavation in the vicinity, and that the exterior and interior surfaces of the pipe showed no signs of degradation. Based on the additional information provided by the applicant, the staff finds the aging management of the concrete piping to be acceptable because the concrete pipe is not in an aggressive environment.

In RAI 3.3.1-10, the staff requested clarification of the environments of the fire water pumps, since the LRA did not differentiate between the internal and external environment for the pump. In its response dated December 19, 2002, the applicant stated that the fire pumps are wet pit, vertical turbine pumps so that both the internal and external environments are raw water and, as such, receive the same aging management. The staff finds this response reasonable and acceptable.

The LRA indicated that the RCP oil collection portion of the fire protection system was consistent with GALL. By letters dated March 14 and August 7, 2003, the applicant stated that the GALL is only applicable to copper drain piping from the drip pans to the collection tank. The rest of the components are constructed of stainless steel; therefore, the GALL is not applicable. For the copper tubing, aging management would be consistent with the GALL report (as reflected in Section 3.3.2.2.6 of this SER), and the staff finds this acceptable. The applicant's letter dated March 14, 2003, stated that the aging effect for the stainless steel components is loss of material, and the aging management would be through the one-time inspection program. The staff finds that the applicant has identified the appropriate aging effect and an adequate aging management program for the stainless steel components. Therefore, staff finds this acceptable.

On the basis of its review of the information provided in the LRA and the additional information provided by the applicant in response to the staff's RAIs, the staff finds that the aging effects identified for the fire protection system components described in LRA Tables 2.3.3.14-1, 3.3-1, 3.3-2, and 3.3-3 are consistent with industry experience for these combinations of materials and environments. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the fire protection system.

Aging Management Programs

The applicant credited the following AMPs for managing the aging effects in the fire protection system:

- Boric Acid Corrosion Prevention Program (3.0.3.6)
- Fire Protection Program (3.0.3.9)
- Periodic Surveillance and Preventive Maintenance Program (3.0.3.10)
- General Corrosion of External Surfaces Program (3.0.3.12)
- One-Time Inspection Program (3.0.3.13)
- Selective Leaching Program (3.0.3.14)

These AMPs are credited for managing the aging effects of components in several structures and systems and, therefore, are considered common AMPs. The staff has evaluated these common AMPs and found them to be acceptable for managing the aging effects identified for this system. These AMPs are evaluated in Sections 3.0.3.6, 3.0.3.9, 3.0.3.10, 3.0.3.12, 3.0.3.13, and 3.0.3.14, respectively, of this SER.

On the basis of its review of the information provided in the LRA, the staff concludes that the above identified AMPs will effectively manage the aging effects of the fire protection system.

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with the fire protection system. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

3.3.2.4.14.3 Conclusions

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and has adequate AMPs for managing the aging effects, for components in the fire protection system, such that the component 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 USAR Supplement program descriptions and concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in the fire protection system to satisfy 10 CFR 54.21(d).

3.3.2.4.15 <u>Raw Water</u>

3.3.2.4.15.1 Summary of Technical Information in the Application

The description of the raw water system can be found in Section 2.3.3.15 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.3.15-1. The components, aging effects, and AMPs are provided in LRA Tables 3.3-1, 3.3-2, and 3.3-3.

Aging Effects

LRA Table 2.3.3.15-1 lists individual system components that are within the scope of license renewal and subject to an AMR. The components include bolting, filters/strainers, flow element/orifice, heat exchanger, indicator (sight glass), orifice plate, pipes and fittings, pump casings, traveling screen frame, and valve bodies.

The LRA states that carbon steel, galvanized steel, cast iron, and copper in air are subject to loss of material due to general external corrosion, and carbon steel and low alloy steel in dripping boric acid are subject to loss of material due to boric acid corrosion. The LRA also states that stainless steel, carbon steel, cast iron, and bronze in raw water are subject to loss of material due to general, pitting, galvanic, and/or crevice corrosion, MIC, biofouling, buildup of deposits, and/or selective leaching. Stainless steel in oxygenated treated water less than 200 °F is subject to loss of material from crevice and pitting corrosion, while stainless steel in corrosion-inhibited treated water is subject to cracking. Carbon steel in corrosion-inhibited water is subject to loss of material. The LRA does not identify any aging effects for stainless steel in air, or for polysulfone in air or raw water.

Aging Management Programs

The following AMPs are utilized to manage aging effects in the raw water system:

- Chemistry Program (B.1.2)
- Boric Acid Corrosion Prevention Program (B.2.1)
- Cooling Water Corrosion Program (B.2.2)
- Periodic Surveillance and Preventive Maintenance Program (B.2.7)
- General Corrosion of External Surfaces Program (B.3.3)
- Selective Leaching Program (B.3.6)

A description of these AMPs is provided in Appendix B of the LRA.

3.3.2.4.15.2 Staff Evaluation

Aging Effects

The staff reviewed the information in LRA Tables 2.3.3.15-1, 3.3-1, 3.3-2, and 3.3-3 for the raw water system. The staff also reviewed the applicant’s responses to the staff’s RAIs.

LRA Table 2.3.3.15-1 refers to LRA Table 3.3-1, Item 16, for several components. LRA Table 3.3-1, Item, 16 covers the loss of material in stainless steel, carbon steel, cast iron, and bronze in raw water, as discussed in GALL. The staff notes that for many of the GALL components that utilize Table 3.3-1, Item 16, the GALL also identifies selective leaching of materials as an applicable aging effect. The selective leaching of these components should be addressed via LRA Table 3.3-1, Item 24, but the LRA does not refer to LRA Table 3.3-1, Item 24, for the raw water system. During the AMR inspection, the staff verified that the cooling water corrosion program will adequately identify and manage any selective leaching that could occur in the raw water system. The staff finds this acceptable.

By letter dated October 11, 2002, the staff issued RAI 3.3-2 pertaining to the descriptions of the internal and external environments included in the LRA. The staff's evaluation of the applicant's response is documented in Section 3.3.2.5.1 of this SER and is characterized as resolved.

On the basis of its review of the information provided in the LRA, and the information included in the applicant's responses to the the staff's RAI, the staff finds that the aging effects identified for the raw water system components described in LRA Tables 2.3.3.15-1, 3.3-1, 3.3-2, and 3.3-3 are consistent with industry experience for these combinations of materials and environments, with the clarification discussed above. Therefore, the staff finds the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the raw water system.

Aging Management Programs

The applicant credited the following AMPs for managing the aging effects in the raw water system:

- Chemistry Program (3.0.3.2)
- Boric Acid Corrosion Prevention Program (3.0.3.6)
- Cooling Water Corrosion Program (3.0.3.7)
- Periodic Surveillance and Preventive Maintenance Program (3.0.3.10)
- General Corrosion of External Surfaces Program (3.0.3.12)
- Selective Leaching Program (3.0.3.14)

These AMPs are credited for managing the aging effects of components in several structures and systems and, therefore, are considered common AMPs. The staff has evaluated these common AMPs and found them to be acceptable for managing the aging effects identified for this system. These AMP are evaluated in Sections 3.0.3.2, 3.0.3.6, 3.0.3.7, 3.0.3.10, 3.0.3.12 and 3.0.3.14, respectively, of this SER.

On the basis of its review of the information provided in the LRA, and based on the on-site inspection and audit, as discussed above, the staff concludes that the above identified AMPs will effectively manage the aging effects of the raw water system.

On the basis of its review, the staff finds that the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with raw water system. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

3.3.2.4.15.3 Conclusions

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and has adequate AMPs for managing the aging effects, for components in the raw water system, such that the component 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 USAR Supplement program descriptions and concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in the raw water system to satisfy 10 CFR 54.21(d).

3.3.2.4.16 Component Cooling Water

3.3.2.4.16.1 Summary of Technical Information in the Application

The description of the component cooling water system (CCW) can be found in Section 2.3.3.16 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.3.16-1. The components, aging effects, and AMPs are provided in LRA Tables 3.3-1, 3.3-2, and 3.3-3.

Aging Effects

LRA Table 2.3.3.16-1 lists individual system components that are within the scope of license renewal and subject to an AMR. The components include accumulators, bolting, filters/strainers, flow element/orifice, heat exchanger, indicator (sight glass), pipes and fittings, pump casings, and valve bodies.

The LRA states that carbon steel, galvanized steel, and copper in air are subject to loss of material due to general external corrosion. Carbon steel, low-alloy steel, galvanized steel, cadmium-plated steel, cast iron, and copper alloy in dripping boric acid are subject to loss of material due to boric acid corrosion. The LRA also states that stainless steel and carbon steel exposed to corrosion-inhibited treated water are subject to loss of material due to general, pitting, and/or crevice corrosion, MIC, and/or cracking. Copper alloy and nickel-based alloy in corrosion-inhibited treated water are subject to loss of material due to crevice and pitting corrosion, galvanic corrosion, and MIC, and copper alloy in corrosion-inhibited treated water is subject to cracking due to SCC. Brass in corrosion-inhibited treated water is subjected to cracking due to SCC. Cast iron and bronze in raw water and soil are subject to selective leaching. Carbon steel and cadmium-plated steel exposed to lubricating oil (with potential water contamination) are subject to loss of material. The LRA does not identify any aging effects for stainless steel or glass in air, carbon steel in nitrogen gas, or glass in corrosion-inhibited treated water.

Aging Management Programs

The following AMPs are utilized to manage aging effects in the CCW:

- Chemistry Program (B.1.2)
- Boric Acid Corrosion Prevention Program (B.2.1)
- Cooling Water Corrosion Program (B.2.2)
- Periodic Surveillance and Preventive Maintenance Program (B.2.7)
- General Corrosion of External Surfaces Program (B.3.3)
- Selective Leaching Program (B.3.6)

These programs are described in Appendix B of the LRA.

3.3.2.4.16.2 Staff Evaluation

Aging Effects

The staff reviewed the information in LRA Tables 2.3.3.16-1, 3.3-1, 3.3-2, and 3.3-3 for CCW. During its review, the staff determined that additional information was needed to complete its review.

In the LRA, the applicant identified the environments for cast iron and bronze pump casings as raw water or soil (link 3.3.1.24). The identified environments do not appear consistent with the description of CCW in the LRA or the USAR. By letter dated October 11, 2002, in RAI 3.3.1-11, the staff requested the applicant to clarify the material and environment for the CCW pumps. By letter dated December 19, 2002, the applicant clarified that the pump casing is cast iron exposed to treated water, and that is consistent with GALL. The applicant credits the selective leaching program, the chemistry program, and the cooling water corrosion program to manage this component. The staff finds this acceptable because the applicant's clarification is consistent with the GALL Report.

By letter dated October 11, 2002, the staff issued RAI 3.3-2 pertaining to the descriptions of the internal and external environments included in the LRA. The staff's evaluation of the applicant's response is documented in Section 3.3.2.5.1 of this SER and is characterized as resolved.

By letter dated October 11, 2002, the staff issued RAI 3.3.3-1 pertaining to aging effects of boric acid corrosion for components in air exposed to leaking and dripping borated treated water. The staff's evaluation of the applicant's response is documented in Section 3.3.2.5.3 of this SER and is characterized as resolved.

On the basis of its review of the information provided in the LRA, and the additional information included in the applicant's response to the above RAIs, the staff finds that the aging effects identified for CCW components described in LRA Tables 2.3.3.16-1, 3.3-1, 3.3-2, and 3.3-3 are consistent with industry experience for these combinations of materials and environments. Therefore, the staff finds the applicant has identified the appropriate aging effects for the materials and environments associated with the components in CCW.

Aging Management Programs

The applicant credited the following AMPs for managing the aging effects in CCW:

- Chemistry Program (3.0.3.2)
- Boric Acid Corrosion Prevention Program (3.0.3.6)
- Cooling Water Corrosion Program (3.0.3.7)
- Periodic Surveillance and Preventive Maintenance Program (3.0.3.10)
- General Corrosion of External Surfaces Program (3.0.3.12)
- Selective Leaching Program (3.0.3.14)

These AMPs are credited for managing the aging effects of components in several structures and systems and, therefore, are considered common AMPs. The staff has evaluated these common AMPs and found them to be acceptable for managing the aging effects identified for this system. These AMP are evaluated in Sections 3.0.3.2, 3.0.3.6, 3.0.3.7, 3.0.3.10, 3.0.3.12 and 3.0.3.14 of this SER.

On the basis of its review of the information provided in the LRA, the staff concludes that the above identified AMPs will effectively manage the aging effects of CCW.

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with the component cooling water system. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

3.3.2.4.16.3 Conclusions

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and has adequate AMPs for managing the aging effects, for components in CCW, such that the component 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 USAR Supplement program descriptions and concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in the component cooling water system to satisfy 10 CFR 54.21(d).

3.3.2.4.17 <u>Liquid Waste Disposal</u>

3.3.2.4.17.1 Summary of Technical Information in the Application

The description of the liquid waste disposal (LWD) system can be found in Section 2.3.3.17 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.3.17-1. The components, aging effects, and AMPs are provided in LRA Tables 3.3-1, 3.3-2, and 3.3-3.

Aging Effects

Table 2.3.3.17-1 of the LRA lists individual system components that are within the scope of license renewal and subject to an AMR. The components include bolting, pipes and fittings, pump casings, and valve bodies.

The LRA states that carbon steel, galvanized steel, and copper in air are subject to loss of material due to general external corrosion, and carbon steel and low alloy steel in dripping boric acid are subject to loss of material due to boric acid corrosion. The LRA also states that stainless steel in borated treated water is subject to cracking due to stress corrosion cracking. The LRA does not identify any aging effects for stainless steel in air or concrete, or for carbon steel or cast iron in concrete.

Aging Management Programs

The following AMPs are utilized to manage aging effects in the LWD system:

- Bolting Integrity Program (B.1.1)
- Boric Acid Corrosion Prevention Program (B.2.1)
- General Corrosion of External Surfaces Program (B.3.3)

These programs are described in Appendix B of the LRA.

3.3.2.4.17.2 Staff Evaluation

Aging Effects

The staff reviewed the information in LRA Tables 2.3.3.17-1, 3.3-1, 3.3-2, and 3.3-3 for the LWD system. During its review, the staff determined that additional information was needed to complete its review.

The staff noted that LRA Table 2.3.3.17-1 deals primarily with external environments and did not appear to cover the internal environments that would be expected in a LWD system. By letter dated October 11, 2002, in RAI 3.3.1-12, the staff requested the applicant to describe the internal environment(s) of the system.

In its response dated December 19, 2002, the applicant stated that the system internal environment was primarily borated treated water inside containment, and raw water (fire water) in the auxiliary building. The applicant stated that LRA Table 3.3.2, Item 96, covered the stainless steel piping in the borated water environment. The applicant added a link to Table 3.3.1, Item 16, to cover carbon steel and stainless steel pipes, fittings, and valve bodies in raw water. For these carbon steel and stainless steel components that are exposed to raw water (fire protection water), the corresponding aging effect is loss of material due to general, pitting, crevice, and galvanic corrosion, MIC, and biofouling. Since for many plants the LWD system is connected to floor drains, the staff questioned the applicant's assertion that the piping inside containment is only subject to borated treated water. The staff believed that the environment may contain higher concentrations of impurities than would be found in borated treated water and, consequently, the applicant may not have adequately identified the aging effects for the piping inside containment. By letter dated February 20, 2003, the staff issued POI-10(d), requesting the applicant to address the potential for higher concentrations of impurities in this system, and the resultant effect on aging. By letter dated March 14, 2003, the applicant responded to POI-10(d) by stating that LRA Table 2.3.3.17-1 has been modified to change the intended functions from "pressure boundary" and "water suppression support" to "fluid boundary." The waste disposal drain piping that is not within scope does not have a pressure retention function because it is never pressurized. It is in scope only for fire water removal in the event of a fire. The applicant stated that a drainage channel is present on the floor once the concrete sets around the embedded piping, and the drainage function would still be completed without the piping.

The applicant also stated that there are no contaminants in containment that would cause additional AERMs beyond those already included for this piping. Stainless steel in a water environment is only subject to cracking, a conservative assumption for this application because for cracking to occur in stainless steel, specific halide levels are required with elevated temperatures and material stress. None of these are present in the LWD piping, therefore, cracking could not occur. Further, in its March 14, 2003, response to POI-10(f) (discussed below), the applicant stated that the drain lines at FCS are pitched to drain, do not contain dead legs, are only subjected to trickle flow, and the water most likely to be drained does not contain sediment. Additionally, the applicant stated that the piping is normally dry. The staff reviewed the applicant's response and finds it acceptable because the AERMs associated with the piping are already addressed. On this basis, POI-10(d) is resolved.

It should be noted that the applicant's response to RAI 3.3.1-12 also stated that the pump casings, which are included in LRA Table 2.3.3.17-1, are not within the scope of license renewal because the pumps are not required for the LWD system to perform its intended license renewal function of firewater removal. This is consistent with the system description in the LRA and the associated boundary drawings; therefore, the staff finds this acceptable.

For pipes and fittings in LRA Table 2.3.3.17-1, the LRA refers to carbon steel and stainless steel in a concrete environment (LRA Table 3.3-2, Items 3.3.2.22, 3.3.2.26, and 3.3.2.65) and concludes that there are no applicable aging effects. Industry experience has shown that carbon steel can degrade in a concrete environment. By letter dated October 11, 2002, in RAI 3.3.1-13, the staff requested the applicant to provide additional information on the concrete environment to demonstrate that there are no applicable aging effects, or provide a program to manage aging of these pipes and fittings. In its response dated December 19, 2002, the applicant stated that, if through-wall perforation of the LWD system piping occurred, there would still be a clear channel for drainage of fire suppression water from the area of concern down to the sump, and therefore no aging management is required. While this is generally in keeping with the intended function of the system, the applicant had not demonstrated that the aging would be limited to a through-wall perforation as opposed to blockage of the piping. By letter dated February 20, 2003, the staff issued POI-10(f), requesting the applicant to justify the assumption that aging of the piping in question will not lead to blockage. By letter dated March 14, 2003, the applicant responded to POI-10(f) by stating that the drain lines at FCS are pitched to drain, do not contain dead legs, are subject to trickle flow rather than full flow, and the water most likely to be drained does not contain any sediment (as is contained in raw water). Also, since the piping is normally dry, any material buildup that could produce blockage is unlikely. Finally, the piping diameter is such that, should swelling occur as a result of corrosion, total blockage of the flow path would not occur. The staff reviewed the applicant's response and finds it acceptable because the information supports the conclusion that blockage of piping is not likely to occur. POI-10(f) is resolved.

By letter dated October 11, 2002, the staff issued RAI 3.3-2 pertaining to the descriptions of the internal and external environments included in the LRA. The staff's evaluation of the applicant's response is documented in Section 3.3.2.3.5.1 of this SER and is characterized as resolved.

On the basis of its review of the information provided in the LRA, and the additional information included in the applicant's response to the above RAIs, the staff finds that the aging effects identified for the LWD system components described in LRA Tables 2.3.3.17-1, 3.3-1, 3.3-2, and 3.3-3 are consistent with industry experience for these combinations of materials and environments. Therefore, with the exception of the above, the staff finds the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the LWD system.

Aging Management Programs

In addition to the three AMPs identified in the LRA, the applicant's response to RAI 3.3.1-12 states that the cooling water corrosion program will be used for the piping in the auxiliary building. Therefore, the following AMPs are credited for managing the aging effects in the liquid waste disposal system:

- Bolting Integrity Program (3.0.3.1)
- Boric Acid Corrosion Prevention Program (3.0.3.6)
- Cooling Water Corrosion Program (3.0.3.7)
- General Corrosion of External Surfaces Program (3.0.3.12)

LRA Table 3.3-2 states that the PS/PMP will provide the aging management for the stainless steel components in the borated treated water environment. Section 2.3.3.17 of the LRA indicates that these components are within the scope of license renewal due to their function to provide containment isolation. The staff notes that, while borated treated water may be the expected environment during an event for which this system has a license renewal intended function, in many plants the LWD system is connected to floor drains and, as such, the piping inside containment is likely to contain water with higher impurities than borated treated water. Therefore, citing this environment may not result in an adequate frequency of inspection or inspection for all applicable aging effects. By letter dated February 20, 2002, the staff issued POI-10(e), requesting the applicant to verify that the type of inspections and the inspection frequency are appropriate, if there is a potential for higher concentrations of impurities in the system. By letter dated March 14, 2003, the applicant responded to POI-10(e) by restating its response to POI-10(d), that there are no contaminants in containment that would cause additional AERMs beyond those already included for this piping. Stainless steel in a water environment is only subject to cracking (a conservative assumption for this application) because for cracking to occur in stainless steel, specific halide levels are required with elevated temperatures and material stress. None of these are present in the LWD piping. Therefore, cracking could not occur. The staff reviewed the applicant's response and finds it acceptable because all applicable aging effects are already addressed. On this basis, POI-10(e) is resolved.

Section 2.3.3.17 of the LRA indicates that the components in the auxiliary building are in the scope of license renewal due to their function of providing flood mitigation. These components are connected to floor drains. The staff notes that the LRA Table 3.3.1, Item 16, link that was added in the response to RAI 3.3.1-12 for these components credits the cooling water corrosion program for aging management. For the raw water environment, the cooling water corrosion program is essentially a GL 89-13 program designed for cooling water systems. It was not clear to the staff how this program will be used to manage the aging of piping in the LWD system. By letter dated February 20, 2003, the staff issued POI-10(g) requesting the applicant to describe how the cooling water corrosion program will be used to manage the aging of piping in the liquid waste system. By letter dated March 14, 2003, the applicant responded to POI-10(g) by clarifying that link 3.3.1.16 in LRA Table 2.3.3.17-1 for "Pipes & Fittings" and "Valve Bodies" was an error and has been deleted (a revised LRA Table 2.3.3.17-1 was provided with the POI response). On the basis of the revision, the staff finds the applicant's response acceptable. POI-10(g) is resolved.

These AMPs are credited for managing the aging effects of components in several structures and systems and, therefore, are considered common AMPs. The staff has evaluated these common AMPs and has found them to be acceptable for managing the aging effects identified for this system. These AMPs are evaluated in Sections 3.0.3.1, 3.0.3.6, 3.0.3.7, and 3.0.3.12 of this SER.

On the basis of its review of the information provided in the LRA, and the additional information included in the applicant's response to the staff's RAIs, the staff concludes that the above identified AMPs will effectively manage the aging effects of the LWD system.

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with the LWD system. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

3.3.2.4.17.3 Conclusions

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and has adequate AMPs for managing the aging effects, for components in the liquid waste disposal system, such that the component 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 USAR Supplement program descriptions and concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in the liquid waste disposal system to satisfy 10 CFR 54.21(d).

3.3.2.4.18 Gaseous Waste Disposal

3.3.2.4.18.1 Summary of Technical Information in the Application

The description of the gaseous waste disposal (GWD) system can be found in Section 2.3.3.18 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.3.18-1. The components, aging effects, and AMPs are provided in LRA Tables 3.3-1, 3.3-2, and 3.3-3.

Aging Effects

Components of the GWD system are described in LRA Section 2.3.3.18 as being within the scope of license renewal, and subject to an AMR. LRA Table 2.3.3.18-1 lists individual components of the system including bolting, heat exchanger, pipes and fittings, and valve bodies. Carbon steel components are identified as being subject to loss of material due to general, pitting, and crevice corrosion, and MIC from exposure to ambient (warm, moist) air. Exposure of stainless steel components to ambient air and gas-nitrogen air has no aging effects. Closure bolting and external surfaces of carbon steel and low-alloy steel components are identified as being subject to loss of material due to boric acid corrosion from exposure to borated water leaking from adjacent systems or components containing borated treated water. Carbon steel components are identified as being subject to loss of material due to general, pitting, and crevice corrosion from exposure to corrosion-inhibited treated water. In addition, carbon steel components are identified as being subject to loss of material due to general, pitting, crevice, and galvanic corrosion from exposure to oxygenated treated water with a temperature less than 200 °F. Stainless steel components are identified as being subject to cracking due to exposure to halogens and sulfates. Stainless steel components are also identified as being subject to crevice and pitting corrosion from exposure to oxygenated treated water with a temperature less than 200 °F. In addition, stainless steel components are identified as being subject to loss of material due to general, pitting, and crevice corrosion from exposure to corrosion-inhibited treated water.

Aging Management Programs

The following AMPs are utilized to manage aging effects in the GWD system:

- Chemistry Program (B.1.2)
- Boric Acid Corrosion Prevention Program (B.2.6)
- Cooling Water Corrosion Program (B.2.2)
- Periodic Surveillance and Preventive Maintenance Program (B.2.7)
- General Corrosion of External Surfaces Program (B.3.3)

A description of these AMPs is provided in Appendix B of the LRA.

3.3.2.4.18.2 Staff Evaluation

Aging Effects

The staff reviewed the information in LRA Tables 2.3.3.18-1, 3.3-1, 3.3-2, and 3.3-3 for the GWD system. During its review, the staff determined that additional information was needed to complete its review.

By letter dated October 11, 2002, the staff issued RAI 3.3-2 pertaining to the description of the internal and external environments included in the LRA. The staff's evaluation of the applicant's response is documented in Section 3.3.2.5.1 of this SER and is characterized as resolved.

On the basis of its review of the information provided in the LRA, and the additional information included in the applicant's response to the above RAI, the staff finds that the aging effects that result from contact of the GWD system to the environments described in LRA Tables 2.3.3.18-1, 3.3-1, 3.3-2, and 3.3-3 are consistent with industry experience for these combinations of materials and environments. Therefore, the staff finds the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the GWD system.

Aging Management Program

The applicant credited the following AMPs for managing the aging effects in the GWD system:

- Chemistry Program (3.0.3.2)
- Boric Acid Corrosion Prevention Program (3.0.3.6)
- Cooling Water Corrosion Program (3.0.3.7)
- Periodic Surveillance and Preventive Maintenance Program (3.0.3.10)
- General Corrosion of External Surfaces Program (3.0.3.12)

These AMPs are credited for managing the aging effects of several components in other structures and systems and are, therefore, considered common AMPs. The staff has evaluated these common AMPs and found them to be acceptable for managing the aging effects identified for this system. The staff's evaluation of these AMPs is documented in Sections 3.0.3.2, 3.0.3.6, 3.0.3.7, 3.0.3.10, and 3.0.3.12 of this SER.

On the basis of its review of the information provided in the LRA, the staff concludes that the above identified AMPs will effectively manage the aging effects of the GWD system.

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with the GWD system. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

3.3.2.4.18.3 Conclusions

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and AMPs credited for managing the aging effects, for components in the gaseous waste disposal system, such that the component 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 USAR Supplement program descriptions and concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in the gaseous waste disposal system to satisfy 10 CFR 54.21(d).

3.3.2.4.19 Primary Sampling

3.3.2.4.19.1 Summary of Technical Information in the Application

The description of the primary sampling (PS) system can be found in Section 2.3.3.19 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.3.19-1. The components, aging effects, and AMPs are provided in LRA Tables 3.3-1, 3.3-2, and 3.3-3.

Aging Effects

Table 2.3.3.19-1 of the LRA lists individual system components that are within the scope of license renewal and subject to an AMR. The components include bolting, heat exchanger, pipes and fittings, and valve bodies.

Carbon steel components are identified as being subject to loss of material due to general, pitting, and crevice corrosion from exposure to ambient (warm, moist) air, dripping boric acid, or corrosion-inhibited treated water. Carbon steel and low-alloy steel bolting are identified as being subject to loss of material and cracking. Stainless steel components exposed to deoxygenated treated water greater than 200 °F and corrosion-inhibited treated water are subject to cracking and loss of material due to crevice and pitting corrosion. Stainless steel exposed to borated treated water is subject to stress corrosion cracking. Brass, copper alloy, and nickel-based alloy in corrosion-inhibited treated water are subject to loss of material due to pitting, crevice, and galvanic corrosion, and/or MIC. Nickel-based alloy exposed to deoxygenated treated water greater than 200 °F is subject to cracking due to crevice corrosion, pitting corrosion, and MIC. No aging effects are identified for stainless steel, brass, bronze, copper, copper alloy, copper-zinc alloy, or nickel-based alloy exposed to ambient air, or copper and copper alloy in refrigerant.

The heat exchanger for primary water, and the pipes, fittings, and valve bodies for secondary water, are subject to time-limiting aging analyses for fatigue.

Aging Management Programs

The following AMPs are utilized to manage aging effects in the primary sampling system:

- Bolting Integrity Program (B.1.1)
- Chemistry Program (B.1.2)
- Boric Acid Corrosion Prevention Program (B.2.1)
- Cooling Water Corrosion Program (B.2.2)
- General Corrosion of External Surfaces Program (B.3.3)
- One-Time Inspection Program (B.3.5)

These programs are described in Appendix B of the LRA.

3.3.2.4.19.2 Staff Evaluation

Aging Effects

The staff reviewed the information in LRA Tables 2.3.3.19-1, 3.3-1, 3.3-2, and 3.3-3 for the PS system. The staff also reviewed the applicant's responses to the staff's requests for additional information.

By letter dated October 11, 2002, the staff issued RAI 3.3-2 pertaining to the description of the internal and external environments included in the LRA. The staff's evaluation of the applicant's response is documented in Section 3.3.2.5.1 of this SER and is characterized as resolved.

On the basis of its review of the information provided in the LRA, and the information included in the applicant's response to the RAI, the staff finds that the aging effects identified for the PS system components described in Tables 2.3.3.19-1, 3.3-1, 3.3-2, and 3.3-3 are consistent with industry experience for these combinations of materials and environments. Therefore, the staff finds that the applicant has identified the appropriate aging effects for the materials and environments associated with the components in the PS system.

Aging Management Programs

The applicant credited the following AMPs for managing the aging effects in the PS system:

- Bolting Integrity Program (3.0.3.1)
- Chemistry Program (3.0.3.2)
- Boric Acid Corrosion Prevention Program (3.0.3.6)
- Cooling Water Corrosion Program (3.0.3.7)
- General Corrosion of External Surfaces Program (3.0.3.12)
- One-Time Inspection Program (3.0.3.13)

These AMPs are credited for managing the aging effects of components in several structures and systems and, therefore, are considered common AMPs. The staff has evaluated these common AMPs and found them to be acceptable for managing the aging effects identified for this system. These AMPs are evaluated in Sections 3.0.3.1, 3.0.3.2, 3.0.3.6, 3.0.3.7, 3.0.3.12, and 3.0.3.13, respectively, of this SER.

The applicant's response to RAI 3.3-2 clarifies that deoxygenated treated water greater than 200 °F corresponds to secondary water. The staff notes that for a nickel-based alloy in this environment, the applicant credits inspections under the cooling water corrosion program to verify the effectiveness of the chemistry program for a heat exchanger; however, the cooling water corrosion program is designed for the closed cooling system, which is the "other side" of the heat exchanger. During the onsite AMR inspection and audit, the staff verified that the applicant is performing inspections of the nickel-base alloy in secondary water as part of the cooling water corrosion program activities. The staff finds this acceptable.

The fatigue of the PS system is addressed by two TLAAs. For the heat exchanger (which cools primary water), the applicant refers to the TLAA in Section 4.3.1 of the LRA, "Reactor Coolant and Associated System Fatigue." For the valves, piping, and fittings associated with the secondary water, the applicant refers to the TLAA in Section 4.3.4 of the LRA, "Fatigue of Class II and III Components." These TLAAs are evaluated in Section 4.3 of this SER.

On the basis of its review of the information provided in the LRA, and the additional information included in the applicant's response to the above RAI, the staff concludes that the above identified AMPs and TLAAs will effectively manage the aging effects of the PS system.

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with the PS system. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

3.3.2.4.19.3 Conclusions

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and has adequate AMPs and TLAAs for managing the aging effects, for components in the primary sampling system, such that the component 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 USAR Supplement program descriptions and concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in the primary sampling system to satisfy 10 CFR 54.21(d).

3.3.2.4.20 Radiation Monitoring-Mechanical

3.3.2.4.20.1 Summary of Technical Information in the Application

The description of the radiation monitoring system (RMS) can be found in Section 2.3.3.20 of this SER. The passive, long-lived components in this system that are subject to an AMR are identified in LRA Table 2.3.3.20-1. The components, aging effects, and AMPs are provided in LRA Tables 3.3-1, 3.3-2, and 3.3-3.

Aging Effects

LRA Table 2.3.3.20-1 lists individual components of the system, including bolting, filters/strainers, pipes and fittings, pressure vessel, pump casings, transmitter element, and valve bodies. The LRA states that the components are constructed of stainless steel, brass, bronze, copper, copper alloy and/or copper-zinc alloy, and are exposed to air. In addition, the LRA states that exposure of these components to ambient air does not result in any aging effects requiring management.

Aging Management Programs

The LRA states that exposure of the RMS components to ambient air does not result in any aging effects requiring management; therefore, the applicant did not identify any AMPs for this system.

3.3.2.4.20.2 Staff Evaluation

The staff reviewed the information in LRA Tables 2.3.3.20-1, 3.3-1, 3.3-2, and 3.3-3 for the RMS, and the applicant's responses to the staff's RAI. The LRA states that the stainless steel, brass, bronze, copper, copper alloy and/or copper-zinc alloy components are exposed to "ambient air." In its December 19, 2002, response to RAI 3.3-2, the applicant clarified that for the purposes of the AMR, there was no differentiation between indoor air, outdoor air, or containment air relative to the applicable AERMs, and that all applicable AERMs that could apply for worst case ambient air conditions were assumed. The staff finds this clarification reasonable for the RMS. The staff's evaluation of the applicant's response to RAI 3.3-2 is documented in Section 3.3.2.5.1 of this SER and is characterized as resolved.

On the basis of its review of the information provided in the LRA, and the additional information included in the applicant's response to the above RAI, the staff finds that the applicant's assessment of the aging effects of the RMS components is consistent with industry experience for these combinations of materials and environments. Therefore, the staff concurs that the above components do not require aging management.

3.3.2.4.20.3 Conclusions

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects for components in the RMS (no AERMs were identified), such that the component intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.5 General AMR Issues

This section discusses the staff's evaluation of three general AMR issues that are applicable to components in several auxiliary systems included in Section 3.3 of the LRA.

3.3.2.5.1 Internal and External Environments

Numerous tables included in the application list the component material and the environment to which the component is exposed. However, the applicant did not provide a description of these environments in the LRA. It should be noted that aging effect depends on the component material as well as the plant-specific environment characteristic. For example, the aging effect of a component exposed to an air environment is dependent, in part, on the type of air, the temperature, the oxygen content, and the water content (humidity), etc. By letter dated October 11, 2002, in RAI 3.3-2, the staff requested the applicant to provide a description of these environments included in the LRA.

In its response dated December 19, 2002, the applicant provided a description of the internal and external environments included in the LRA. The applicant stated that in the FCS LRA, the environments used in the Section 3 AMR tables match those that are used in the GALL Report. In all of the 3.X-1 tables, each line item corresponds exactly with a GALL Report line item. The same is true for the 3.X-3 tables. Where there is a differentiation relative to the temperature, oxygen content, use of a corrosion inhibitor, etc., within an environment specified in the GALL Report (e.g., high temperature borated treated water, deoxygenated treated water >200 °F, oxygenated treated water <200 °F, etc.), the same differentiation has been used in the FCS LRA.
For ambient air at FCS, to simplify the IPA and review processes, there was no differentiation made between indoor air, outdoor air, or containment air relative to applicable AERMs. All applicable AERMs that could apply for worst-case ambient air conditions were assumed wherever a material was subjected to an ambient air environment. The use of descriptors such as plant indoor air, outdoor air, ambient air, containment air, etc., were used to address locale only and had nothing to do with the determination of AERMs. In addition, a component in ambient air could be subjected to local borated water leakage. Then, the AERMs associated with exposure to borated water would apply.

On the basis of its review, the staff finds the applicant's response acceptable because the information provided by the applicant defines and clarifies the environments included in the LRA.

3.3.2.5.2 Elastomer Components in Ventilation Systems

Numerous ventilation systems discussed in LRA Section 2.3 include elastomer components in the system. Normally ventilation systems contain elastomer materials in duct seals, flexible collars between ducts and fans, rubber boots, etc. For some plant designs, elastomer components are used as vibration isolators to prevent transmission of vibration and dynamic loading to the rest of the system. In LRA Table 3.3-1, row number 3.3.1.02, the applicant identified the aging effects of hardening, cracks, and loss of strength due to elastomer degradation, and loss of material due to wear for these elastomer components. To manage these aging effects, the applicant relied on its general corrosion of external surfaces program, described in LRA Section B.3.3. The description for this program identifies loss of material and cracking as plausible aging effects. The applicant stated that these aging effects can be detected by visual observation and inspection of external surfaces performed at intervals based on previous inspections and industry experience. By letter dated October 11, 2002, in RAI 3.3.1-1, the staff requested the applicant to clarify the discrepancy between LRA Table 3.3-1, row number 3.3.1.02, and LRA Section B.3.3 regarding the aging effects of concern. Specifically, the applicant is requested to clarify whether hardening and loss of strength are considered in the general corrosion of external surfaces program, and how these aging effects will be detected and managed using this program. In addition, the applicant was requested to provide the frequency of the subject inspection described in LRA Section B.3.3 for the applicable elastomer components, including a discussion of the operating history to demonstrate that the applicable aging effects will be detected prior to the loss of their intended function.

In its response dated December 19, 2002, the applicant stated that the aging effects of hardening and loss of strength for elastomers are not included in the general corrosion of external surfaces program (B.3.3). Enhancements will be made to add these AERMs to preventive maintenance tasks under the PS/PMP (B.2.7) to specifically perform hands on type inspections of elastomer expansion joints, seals, and vibration isolators within the scope of license renewal for hardening and loss of strength. Applicable preventive maintenance is performed at least once per refueling cycle (approximately 18 months). The PS/PMP has been added to Discussion Item 2 in AMR Item 3.3.1.02.

Relative to monitoring for cracks and loss of material, procedural guidance requires system engineers to perform walkdowns of their assigned systems on a quarterly basis, as a minimum. Operator walkdowns occur multiple times per 12-hour shift. No instances of the loss of ventilation system intended function due to failure of elastomers have been found in existing corrective action documentation.

On the basis of its review, the staff finds the applicant's response adequate and acceptable because the information provided by the applicant clarifies that the aging effects of hardening and loss of strength for elastomers are managed by the PS/PMP that is performed at least once per refueling cycle, the monitoring for cracking and loss of material is performed during the walkdowns by system engineers on a quarterly basis, as a minimum, and no instances of the loss of ventilation system intended function due to failure of elastomers have been found in existing corrective action documentation. Therefore, the applicant has demonstrated that the applicable aging degradation of these elastomer components will be detected prior to the loss of their intended function.

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects for elastomer components in ventilation systems such that the component 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 USAR Supplement program description and concludes that the USAR Supplement provides an adequate description of the AMP credited for managing aging in elastomer components in ventilation systems to satisfy 10 CFR 54.21(d).

3.3.2.5.3 Boric Acid Corrosion

For several components in the auxiliary systems, the applicant referred to LRA Table 3.3-3, row number 3.3.3.09, for the AMR results for these components. In that table, the applicant identified “ambient air” as the environment and credited the boric acid corrosion prevention program for managing the aging effect. The applicant also referred to row number 3.3.1.13 of LRA Table 3.3-1 as the applicable GALL Report AMR result. The staff noted that the GALL Report item addresses aging effects for the component group in air exposed to leaking and dripping borated treated water. By letter dated October 11, 2002, in RAI 3.3.3-1, the staff requested the applicant to clarify that “boric water leaks” rather than “ambient air” is the environment characteristic of concern.

In its response dated December 19, 2002, the applicant stated that the normal environment for these components is ambient air. It is possible, although improbable, that there can be leakage of water from borated water systems onto exposed carbon steel surfaces. For this reason, that possibility is covered by providing the link through AMR Item 3.3.3.09 to AMR Item 3.3.1.13, which corresponds to GALL Report Item VII.I.1-a. In addition, LRA Table 3.3-3, row number 3.3.3.09, has been revised to read “Loss of material due to boric acid corrosion” in the FCS AERMs column to correctly match AMR Item 3.3.1.13.

On the basis of its review, the staff finds the applicant’s response adequate and acceptable because the information provided by the applicant clarifies that “boric water leaks” rather than “ambient air” is the environment characteristic of concern and that is consistent with the corresponding GALL Report Item VII.1.1-a.

3.3.2.5.4 Conclusions

The staff has evaluated the general AMR issues discussed above and concludes that, on the basis of the staff’s review of the LRA and the applicant’s responses to the staff’s RAIs, the applicant has adequately considered (1) internal and external environments, (2) elastomer components in ventilation systems, and (3) boric acid corrosion, in its aging management evaluations, and that the components will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR Supplement program description and concludes that the USAR Supplement provides an adequate description of the AMP credited for managing aging in elastomer components in ventilation systems to satisfy 10 CFR 54.21(d).

3.3.3 Evaluation Findings

The staff has reviewed the information in Section 3.3 of the LRA. On the basis of its review, the staff concludes that the applicant has demonstrated that the aging effects associated with the auxiliary systems will be adequately managed so that these systems will perform their intended functions in accordance with the current licensing basis during the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR Supplement program descriptions and concludes that the USAR Supplements provide adequate program descriptions of the AMPs credited for managing aging in the auxiliary systems to satisfy 10 CFR 54.21(d).

3.4 Steam and Power Conversion Systems

This section addresses the aging management of the components of the steam and power conversion systems (SPCS) group. The systems that make up the SPCS group are described in the following SER sections:

- Feedwater (2.3.4.1)
- Auxiliary Feedwater (2.3.4.2)
- Main Steam and Turbine Steam Extraction (2.3.4.3)

As discussed in Section 3.0.1 of this SER, the components in each of the SPCS are included in one of three LRA tables. LRA Table 3.4-1 consists of SPCS components that are evaluated in the GALL Report, LRA Table 3.4-2 consists of SPCS components that are not evaluated in the GALL Report, and LRA Table 3.4-3 consists of SPCS components that are not evaluated in the GALL Report, but the applicant has determined can be managed using a GALL AMR and associated AMP.

3.4.1 Summary of Technical Information in the Application

In LRA Section 3.4, the applicant described its AMRs for the SPCS group at FCS. The passive, long-lived components in these systems that are subject to an AMR are identified in LRA Tables 2.3.4.1-1, 2.3.4.2-1, and 2.3.4.3-1.

The applicant's AMRs included an evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify aging effects that require management. These reviews concluded that the aging effects requiring management based on FCS operating experience were consistent with aging effects identified in GALL. The applicant's review of industry operating experience included a review of operating experience through 2001. The results of this review concluded that aging effects requiring management based on industry operating experience were consistent with aging effects identified in GALL. The applicant's ongoing review of plant-specific and industry operating experience is conducted in accordance with the FCS operating experience program.

3.4.2 Staff Evaluation

In Section 3.4 of the LRA, the applicant described its AMR for the SPCS at FCS. The staff reviewed Section 3.4 to determine whether the applicant has provided sufficient information to demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis throughout the period of extended operation, in accordance with the requirements of 10 CFR 54.21(a)(3), for the SPCS components that are determined to be within the scope of license renewal and subject to an AMR.

The systems that make up the SPCS group are (1) feedwater, (2) auxiliary feedwater, and (3) main steam and turbine steam extraction. Generally, the steam generator blowdown system is also within the scope of license renewal and included as one of the SPCS. In RAI 2.3.4-1, the staff requested further information regarding the omission of this system from the SPCS. In response, the applicant stated that the steam generator blowdown system is within the scope of license renewal; however, the system has not been evaluated as a separate system. Rather, the steam generator blowdown system has been evaluated within other in-scope systems. Further discussion regarding the steam generator blowdown system can be found in Section 2.3.4 of this SER.

The applicant referenced the GALL Report in its AMR. The staff has previously evaluated the adequacy of the aging management of SPCS components for license renewal as documented in the GALL Report. Thus, the staff did not repeat its review of the matters described in the GALL Report, except to ensure that the material presented in the LRA was applicable, and to verify that the applicant had identified the appropriate programs as described and evaluated in the GALL Report. The staff evaluated those aging management issues recommended for further evaluation in the GALL Report. The staff also reviewed aging management information submitted by the applicant that was different from that in the GALL Report or was not addressed in the GALL Report.

Table 3.4-1 below provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.4 that are addressed in the GALL Report.

Table 3.4-1

Staff Evaluation Table for FCS Steam and Power Conversion System Components Evaluated in the GALL Report

Component Group	Aging Effect/Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Piping and Fittings in main feedwater line, steam line and AFW piping (PWR only)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	TLAA	Consistent with GALL. GALL recommends further evaluation (See Section 3.4.2.2.1 below)
Piping and fittings, valve bodies and bonnets, pump casings, tanks, tubes, tubesheets, channel head and shell (except main steam system)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Water chemistry and one-time inspection	Chemistry Program and One-Time Inspection Program	Consistent with GALL. GALL recommends further evaluation (See Section 3.4.2.2.2 below)
Auxiliary feedwater (AFW) piping	Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling	Plant specific	Not applicable to FCS. AFW piping at FCS is not exposed to untreated water from a backup water supply	Different from GALL (See Section 3.4.2.2.3 below)

Oil coolers in AFW system (lubricating oil side possibly contaminated with water)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion, and MIC	Plant specific	Periodic Surveillance and Preventive Maintenance Program	Consistent with GALL. GALL recommends further evaluation (See Section 3.4.2.2.5 below)
External surface of carbon steel components	Loss of material due to general corrosion	Plant-specific	General Corrosion of External Surfaces Program, Chemistry Program	Consistent with GALL. GALL recommends further evaluation (See Section 3.4.2.2.4 below
Carbon steel piping and valve bodies	Wall thinning due to flow-accelerated corrosion	Flow-accelerated corrosion	Flow-accelerated corrosion	Consistent with GALL (See Section 3.4.2.1 below)
Carbon steel piping and valve bodies in main steam system	Loss of material due to pitting and crevice corrosion	Water chemistry	Water chemistry	Consistent with GALL (See Section 3.4.2.1 below)
Closure bolting in high-pressure or high-temperature systems	Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC	Bolting integrity	Bolting integrity	Consistent with GALL (See Section 3.4.2.1 below)
Heat exchangers and coolers/condensers serviced by open-cycle cooling water	Loss of material due to general (carbon steel only), pitting, and crevice corrosion, MIC, and biofouling; buildup of deposit due to biofouling	Open-cycle cooling water system	The combinations of materials and environment identified in the GALL Report are not applicable to FCS. The applicable heat exchangers are not serviced by open-cycle cooling water	Program Different from GALL (See Section 3.4.2.3 below)
Heat exchangers and coolers/condensers serviced by closed-cycle cooling water	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Closed-cycle cooling system	Chemistry Program, Cooling Water Corrosion Program	Program Different from GALL (See Section 3.4.2.3 below)
External surface of above-ground condensate storage tank	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Above-ground carbon steel tanks	Not applicable to FCS	Program Different from GALL (See Section 3.4.2.3 below)
External surface of buried condensate storage tank and AFW piping	Loss of material due to general, pitting, and crevice corrosion, and MIC	Buried piping and tanks surveillance or Buried piping and tanks inspection	Not applicable to FCS	Program Different from GALL (See Section 3.4.2.3 below)
External surface of carbon steel components	Loss of material due to boric acid corrosion	Boric acid corrosion	Boric Acid Corrosion Prevention	Consistent with GALL (See 3.4.2.1 below)

The staff's review of the SPCS for the FCS LRA is contained within four sections of this SER. Section 3.4.2.1 is the staff review of components in the SPCS that the applicant indicates are consistent with GALL and do not require further evaluation. Section 3.4.2.2 is the staff review of components in the SPCS that the applicant indicates are consistent with GALL and GALL recommends further evaluation. Section 3.4.2.3 is the staff evaluation of AMPs that are specific to the SPCS. Section 3.4.2.4 contains an evaluation of the adequacy of aging management for components in each system in the SPCS and includes an evaluation of components in the SPCS that the applicant indicates are not in GALL. This section is divided into three subsections, feedwater, auxiliary feedwater, and main steam and turbine steam extraction, which are the three systems that the applicant has identified as within the SPCS group.

3.4.2.1 Aging Management Evaluations in the GALL Report that Are Relied on for License Renewal, Which Do Not Require Further Evaluation

For component groups evaluated in GALL for which the applicant has claimed consistency with GALL, and for which GALL does not recommend further evaluation, the staff sampled components in these groups during the AMR inspection to determine whether the plant-specific components contained in these GALL component groups were bounded by the GALL evaluation. The staff also sampled component groups during the AMR inspection to determine whether the applicant had properly identified those component groups in GALL that were not applicable to its plant. The results of the staff's AMR inspection can be found in AMR Inspection Report 50-285/03-07, dated March 20, 2003.

On the basis of its review of the inspection results, the staff finds that the applicant's claim of consistency with GALL is acceptable, and that it is acceptable for the applicant to reference the information in the GALL Report for SPCS components. Therefore, on this basis, the staff concludes that the applicant has demonstrated that the components for which the applicant claimed consistency with GALL 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) and that the USAR Supplement provides an adequate summary description of the programs and activities credited for managing the effects of aging for the ESF system components for which the applicant claimed consistency with GALL, as required by 10 CFR 54.21(d).

3.4.2.2 Aging Management Evaluations in the GALL Report that Are Relied on for License Renewal, For Which GALL Recommends Further Evaluation

For component groups evaluated in GALL for which the applicant has claimed consistency with GALL, and for which GALL recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues for which GALL recommended further evaluation. In addition, the staff sampled components in these groups during the AMR inspection to determine whether the plant-specific components contained in these GALL component groups were bounded by the GALL evaluation. The results of the staff's AMR inspection can be found in AMR Inspection Report 50-285/03-07, dated March 20, 2003.

The GALL Report indicates that further evaluation should be performed for the aging effects described in the following sections.

3.4.2.2.1 Cumulative Fatigue Damage

As stated in the SRP-LR, fatigue is a TLAA as defined in 10 CFR 54.3, and is required to be evaluated in accordance with 10 CFR 54.21(c)(1). The staff reviewed the evaluation of this TLAA in Section 4.3 of this SER, following the guidance in Section 4.3 of the SRP-LR.

In LRA Table 3.4-1, row number 3.4.1.01 relates to cumulative fatigue damage of auxiliary feedwater piping and fittings, which is managed by a TLAA, as specified in The GALL Report, Volume 2, VIII.G.1-b. In RAI 3.4.1-13, the staff requested the applicant to clarify whether the TLAA covers the entire auxiliary feedwater system, or just a portion of the system. Note that for the main steam and feedwater systems, GALL line item VII.D1.1-b specifies that only a portion of the piping can utilize a TLAA.

In its response dated December 12, 2002, the applicant referred to Section 4.3.4 of the LRA for discussion relative to the fatigue considerations of Class II and III piping. The applicant stated the following:

> The design code operational limits for this piping, is based on 7000 cycles, is being treated as a TLAA, and is included within the scope of the Fatigue Monitoring Program (B.2.4). Since the Auxiliary Feedwater system is fed from a storage tank inside the Auxiliary Building, the only portions of the AFW system which actually see thermal fatigue cycles are the nozzles and a short section of piping off the Steam Generators.

The staff finds the applicant's response acceptable because it clarifies the scope of the AFW components which are subject to the cumulative fatigue TLAA.

Industry operating experience has identified cracking from mechanical vibration as a potential aging effect for the piping system components in the SPCS. Given this experience, the staff requested the applicant, in RAI 3.4.2-1, to explain why mechanical vibration is not identified as an applicable aging effect for components in the SPCS.

In its response dated December 19, 2002, the applicant stated the following:

> Cracking is already identified and managed as an AERM for applicable components in the Steam and Power Conversion Systems. Mechanical vibration is a mechanism that can result in cracking. At FCS, mechanical vibration is not considered to be an aging issue. It is a design issue. When it occurs, it typically involves the misapplication of mechanical components, the improper sizing of components or piping, the improper location of piping fittings that change flow direction, or some combination of these. As such, cases of mechanical vibration problems, especially where damage has occurred, are eliminated via design changes.

The staff finds the applicant's response reasonable and acceptable because it provides an explanation of how mechanical vibration problems are eliminated at FCS. The RAI issue is therefore considered resolved.

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of cumulative fatigue damage for components in the SPCS, as recommended in the GALL Report.

The staff reviewed the USAR Supplement for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for the SPCS components for which the applicant claimed consistency with GALL to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated cumulative fatigue damage for SPCS components, as recommended in the GALL Report.

3.4.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

As stated in the SRP-LR, the GALL Report recommends further evaluation of programs to manage loss of material due to general, pitting, and crevice corrosion of carbon steel piping and fittings, valve bodies and bonnets, pump casings, pump suction and discharge lines, tanks, tubesheets, channel heads, and shells (except for main steam system components), and for loss of material due to crevice and pitting corrosion for stainless steel tanks and heat exchanger/cooler tubes. The GALL water chemistry program relies on monitoring and control of water chemistry, based on the guidelines in EPRI TR-102134, "PWR Secondary Water Chemistry Guideline," Revision 3, May 1993, for secondary water chemistry in PWRs, to manage the effect of loss of material due to general, pitting, or crevice corrosion. However, corrosion may occur at locations of stagnant flow conditions. Therefore, the GALL Report recommends that the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring.

The applicant proposed a one-time inspection of select components and susceptible locations to ensure that corrosion is not occurring. The staff reviewed the applicant's proposed program to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation. The staff also verified that the applicant's selection of susceptible locations is based on severity of conditions, time of service, and lowest design margin. The staff also verified that the proposed inspection would be performed using techniques similar to ASME Code and ASTM standards.

With regard to the one-time inspection and the water chemistry programs, GALL recommends inspection of stagnant areas based on severity of condition, time of service, and lowest design margin. In RAI 3.4.1-11, the staff requested the applicant to identify these worst-case locations for components in the feedwater, auxiliary feedwater, and main steam and turbine steam extraction systems, which utilize these programs.

In its response dated December 19, 2002, the applicant stated that the "worst-case locations will be evaluated and identified, taking into account severity of condition, time of service, and lowest design margin, as part of the implementation of the one-time inspection program (B.3.5) prior to the period of extended operation."

The staff finds the applicant's response reasonable and acceptable because it commits the applicant to developing a one-time inspection program for SPCS components which evaluates stagnant areas of the system based on severity of condition, time of service, and lowest design margin, as specified in the GALL Report. The applicant's commitment is found in Appendix A of this SER. RAI 3.4.1-11 is resolved.

The applicant has proposed the chemistry program and the one-time inspection program as the AMPs for managing loss of material due to general, pitting, and crevice corrosion. These programs are evaluated in Section 3.0.3 of this SER and are considered appropriate for managing this aging effect.

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of material due to general, pitting, and crevice corrosion for components in the SPCS, as recommended in the GALL Report.

The staff reviewed the USAR Supplement for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for SPCS components for which the applicant claimed consistency with GALL to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that, pending satisfactory implementation of the commitment discussed above, the applicant has adequately evaluated the management of loss of material due to general, pitting, and crevice corrosion for SPCS components, as recommended in the GALL Report.

3.4.2.2.3 Loss of Material Due to General, Pitting, and Crevice Corrosion, Microbiologically Influenced Corrosion, and Biofouling

As stated in the SRP-LR, the GALL Report recommends further evaluation of programs to manage loss of material due to general corrosion, pitting, and crevice corrosion, MIC, and biofouling for carbon steel piping and fittings for untreated water from the backup water supply in the AFW system. The staff reviewed the applicant's proposed program to ensure that an adequate program will be in place for the management of this aging effect.

In LRA Table 3.4-1, the applicant stated that auxiliary feedwater piping at FCS is not exposed to untreated water from a backup water supply, and therefore, the GALL review results are not applicable to FCS. In RAI 3.4.1-4, the staff stated that auxiliary feedwater piping from the emergency feedwater storage tank (EFWST) appears to be exposed to a ground water, soil and/or outdoor environment, and would fall in the category identified in the GALL Report. In addition, since there is no reference to a program for the buried piping portion of the auxiliary feedwater piping in Section 2.3.4.2-1 of the LRA, the staff requested the applicant to clarify how the aging effects for this portion of the auxiliary feedwater piping will be managed. In its response, the applicant stated the following:

> The EFWST is not outside. It is located inside the Auxiliary Building, therefore, there is no buried AFW piping. Refer to boundary drawing 11405-M-254, Sheet 2. This drawing shows that the tank is located in the Auxiliary Building.

During the AMR inspection and audit, the staff reviewed the auxiliary feedwater water sources and confirmed that auxiliary feedwater piping is not exposed to untreated water. On the basis of the applicant's response to RAI 3.4.1-4, along with the staff's inspection and audit findings, the staff finds that the applicant has correctly concluded that auxiliary feedwater piping is not exposed to untreated water and this aging effect is not applicable.

The staff reviewed the USAR Supplement for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for SPCS components for which the applicant claimed consistency with GALL to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of loss of material due to general pitting, and crevice corrosion, microbiologically-influenced corrosion, and biofouling for SPCS components, as recommended in the GALL Report.

3.4.2.2.4 Loss of Material Due to General Corrosion

As stated in the SRP-LR, the GALL Report recommends further evaluation of programs to manage loss of material due to general corrosion for external surfaces of all carbon steel structures and components, including closure bolting, exposed to operating temperatures less than 212 °F. Such corrosion may be due to air, moisture, or humidity. The staff reviewed the applicant's proposed program to ensure that an adequate program will be in place for the management of this aging effect.

LRA Table 2.3.4.2-1, which lists components subject to AMR for the auxiliary feedwater system, refers to items 3.4.1.02 and 3.4.1.05 for AMR results for tanks. These links in LRA Table 3.4-1 lead to the chemistry program (B.1.2), one-time inspection program (B.3.5), and general corrosion for external surfaces program (B.3.3). However, the one-time inspection program (B.3.5) does not have LRA Table 3.4-1 within its scope and therefore, excludes tanks in the auxiliary feedwater system. In RAI 3.4.1-9, the staff requested the applicant to provide clarification for this discrepancy.

In its response the applicant stated the following:

> The aging management that is addressed in LRA Tables 3.4-1 and 3.4-3 does not require further discussion in Appendix B of the LRA because it is consistent with the aging management described in the equivalent line items of the GALL Report. Since, however, management of the components in LRA Table 3.4-2 is not addressed in the GALL Report, additional discussion is provided in Appendix B of the LRA and/or in the Discussion column of individual LRA Table 3.4-2 AMR items to clarify how aging management is accomplished.

The staff finds the applicant's response acceptable because it provides a clarification as to why the AFW system tanks are not identified in the scope of the one-time inspection program. Therefore the RAI issue is considered resolved.

The applicant has identified the general corrosion of external surfaces program and the chemistry program as the AMPs for managing this aging effect. These programs are evaluated in Section 3.0.3 of this SER and are considered appropriate for managing this aging effect.

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of material due to general corrosion for components in the SPCS, as recommended in the GALL Report.

The staff reviewed the USAR Supplement for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for SPCS components for which the applicant claimed consistency with GALL to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of loss of material due to general corrosion for SPCS components, as recommended in the GALL Report.

3.4.2.2.5 Loss of Material due to General, Pitting, Crevice, and MIC

As stated in the SRP-LR, the GALL Report recommends further evaluation of programs to manage the loss of material due to general corrosion (carbon steel only), pitting and crevice corrosion, and MIC, for stainless steel and carbon steel shells, tubes, and tubesheets within the bearing oil coolers (for steam turbine pumps) in the AFW system. Such corrosion may be due to water contamination that affects the quality of the lubricating oil in the bearing oil coolers. The staff reviewed the applicant's proposed program to ensure that an adequate program will be in place for the management of the aging effect.

The applicant has identified the PS/PMP as the AMP for managing this aging effect. This program is evaluated in Section 3.0.3 of this SER and is considered appropriate for managing this aging effect.

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of material due to general, pitting, and crevice corrosion, and MIC for components in the SPCS, as recommended in the GALL Report.

The staff reviewed the USAR Supplement for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for SPCS components for which the applicant claimed consistency with GALL to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of loss of material due to general, pitting, crevice, and MIC for SPCS components, as recommended in the GALL Report.

3.4.2.2.6 Conclusions

The staff has reviewed the applicant's evaluation of the issues for which GALL recommends further evaluation for components in the SPCS. On the basis of its review, the staff finds that the applicant has provided sufficient information to demonstrate that the issues for which the GALL recommends further evaluation have been adequately addressed and that the subject aging effects will be adequately managed for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the USAR Supplements for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for SPCS components for which the applicant claimed consistency with GALL to satisfy 10 CFR 54.21(d).

3.4.2.3 Aging Management Programs for Steam and Power Conversion Systems Components

In SER Section 3.4.2.1, the staff evaluated the applicant's conformance with the aging management recommended by GALL for the SPCS. In SER Section 3.4.2.2, the staff reviewed the applicant's evaluation of the issues for which GALL recommends further evaluation. In this SER section, the staff presents its evaluation of the programs used by the applicant to manage the aging of the components in the SPCS.

The applicant credits nine AMPs to manage the aging effects associated with components in the SPCS. All nine of the AMPs are credited with managing aging for components in other system groups (common AMPs). The staff's evaluation of the common AMPs credited with managing aging in SPCS components is provided in Section 3.0.3 of this SER. The common AMPs are listed below:

- Bolting Integrity Program - SER Section 3.0.3.1
- Chemistry Program - SER Section 3.0.3.2
- Flow Accelerated Corrosion Program - SER Section 3.0.3.4
- Boric Acid Corrosion Prevention Program - SER Section 3.0.3.6
- Cooling Water Corrosion Program - SER Section 3.0.3.7
- Periodic Surveillance and Preventive Maintenance Program - SER Section 3.0.3.10

- General Corrosion of External Surfaces Program - SER Section 3.0.3.12
- One-Time Inspection Program - SER Section 3.0.3.13
- Selective Leaching Program - SER Section 3.0.3.14

3.4.2.4 Aging Management Review of Plant-Specific Steam and Power Conversion Systems Components

In this section of the SER, the staff presents its review of the applicant's AMR for specific SPCS components. To perform its evaluation, the staff reviewed the components listed in LRA Table 2.3.4.1, 2.3.4.2, and 2.3.4.3 to determine whether the applicant properly identified the applicable aging effects and AMPs needed to adequately manage these aging effects. This portion of the staff's review involved identification of the aging effects for each component, ensuring that each component was evaluated in the appropriate LRA AMR Table in Section 3, and that management of the aging effect was captured in the appropriate AMP. The results of the staff's review are provided below.

3.4.2.4.1 Feedwater

3.4.2.4.1.1 Summary of Technical Information in the Application

The AMR results for the feedwater system are presented in Tables 3.4-1, 3.4-2, and 3.4-3 of the LRA. The applicant used the GALL Report format to present its AMR of feedwater system components in LRA Table 3.4-1. In LRA Tables 3.4-2 and 3.4-3, the applicant identified the component group designation along with its (1) material, (2) environment, (3) aging effect(s), and (4) AMP(s).

As described in LRA Section 2.3.4.1, the feedwater system consists of a supply line to each of the two steam generators. A feedwater isolation valve in each steam generator supply line is located just outside the containment penetration.

Aging Effects

LRA Tables 3.4-1 through 3.4-3 identify the following applicable aging effects for the feedwater system.

- Loss of material of carbon steel components due to general, pitting, and crevice corrosion in treated water
- Loss of material of carbon steel components due to general corrosion of the external surfaces in ambient air
- Wall thinning of carbon steel components due to FAC in steam or treated water
- Loss of material of carbon steel components due to general corrosion, crack initiation, and growth due to cyclic loading in ambient air, in high-pressure or high-temperature systems
- Loss of material of low-alloy steel components due to boric acid corrosion in ambient air and leaking and dripping of chemically treated borated water
- Cracking of stainless steel components in de-oxygenated treated water or saturated steam due to exposure to sulfates or halogens
- Crevice and/or pitting corrosion of stainless steel components due to exposure to dissolved oxygen or halogens and sulfates

Aging Management Programs

The following AMPs are utilized to manage aging effects to the feedwater system.

- Bolting Integrity Program (B.1.1)
- Chemistry Program (B.1.2)
- Flow Accelerated Corrosion Program (B.1.5)
- Boric Acid Corrosion Program (B.2.1)
- General Corrosion of External Surface Program (B.3.3)
- One-Time Inspection Program (B.3.5)

A description of these AMPs is provided in Appendix B of the LRA.

3.4.2.4.1.2 Staff Evaluation

This section of the SER provides the staff's evaluation of the applicant's AMR for the aging effects and the appropriateness of the programs credited for the aging management of the feedwater system components at FCS. The staff's evaluation includes a review of the aging effects considered and the basis for the applicant's elimination of certain aging effects. In addition, the staff has evaluated the appropriateness of the AMPs that are credited for managing the identified aging effects for the feedwater system components.

In addition to Section 3.4 of the LRA, the staff reviewed the pertinent information provided in Section 2.3.4, "Steam and Power Conversion Systems," and the applicable AMP descriptions provided in Appendix B of the LRA to determine whether the aging effects for the feedwater system components have been properly identified and will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Aging Effects

The component groups identified in LRA Table 2.3.4.1-1 for the feedwater system are (1) bolting, (2) pipes and fittings, and (3) valve bodies.

The materials used for bolting in the feedwater system are carbon steel and stainless steel. Consistent with the GALL Report, the applicant identified loss of material as an applicable aging effect for all of the carbon steel bolting in the feedwater system. The different aging mechanisms leading to loss of material for carbon steel bolting in the feedwater system include (1) general corrosion, (2) crack initiation and growth due to SCC, and (3) boric acid corrosion. For stainless steel bolting in ambient air, the applicant did not identify any applicable aging effects.

LRA Table 3.4-1, row 3.4.1.08, discusses aging management of closure bolting, and credits the bolting integrity program (B.1.1) for managing loss of material and crack initiation. LRA Section B.1.1 states that the bolting integrity program will be consistent with GALL Program XI.M3, "Reactor Head Closure Studs" and XI.M18, "Bolting Integrity," with the exception that SCC has not been identified as a creditable aging effect for high-strength carbon steel bolting in plant indoor air. In RAI 3.4.1-3, the staff requested the applicant to discuss the basis for its conclusion that SCC is not a creditable aging effect for bolting.

In its response dated December 19, 2002, the applicant stated the following:

> FCS has not identified SCC as a credible AERM for high strength CS [carbon steel] bolting in plant indoor air. The first reason for this position is that stainless steels, high strength aluminum alloys, and brasses are the most susceptible alloys to SCC. Ordinary steels are not as susceptible. Secondly, SCC requires exposure to specific chemical solutions for the mechanism to occur. Stainless steels require chloride-laden solutions. Aluminum alloys require sodium chloride solutions. Brasses require ammonia solutions. Ordinary steels require exposure to caustic or mixed acid solutions. Thirdly, elevated temperature is usually a factor when SCC occurs. For the CS steel bolting in question, therefore, (1) the material is not readily susceptible to SCC, (2) a caustic or mixed acid solution environment is not present, and (3) elevated temperatures are not present.

The staff finds the applicant's response reasonable and acceptable because it provides a satisfactory explanation for excluding SCC as a credible aging effect. The RAI issue is considered resolved.

The materials used for pipes, fittings, and valve bodies in the feedwater system are carbon steel and stainless steel. Consistent with the GALL Report, the applicant identified loss of material as an applicable aging effect for these components in the feedwater system. The aging mechanisms leading to loss of material for carbon steel pipes, fittings, and valve bodies include general corrosion, boric acid corrosion, and FAC, depending on the local environment. For stainless steel pipes, fittings, and valve bodies in the feedwater system, the applicant identified cracking and loss of material as applicable aging effects for the components exposed to de-oxygenated treated water or saturated steam. For stainless steel components in ambient air, the applicant did not identify any applicable aging effects.

In RAI 3.4-1, the staff requested the applicant to indicate if any of the feedwater system components might be susceptible to galvanic corrosion. In response, the applicant stated that they have identified components in the feedwater system, the auxiliary feedwater system, and the main steam system that are potentially subject to galvanic corrosion. However, galvanic corrosion is not specifically managed since the applicant does not consider it to be a plausible aging mechanism for FCS. Galvanic corrosion leads to the aging effect loss of material, which is specifically managed for the components in the SPCS. The staff finds the applicant's response acceptable because the applicant has identified the AMPs to manage loss of material.

On the basis of its review of the LRA and the applicant's RAI responses, the staff finds the applicant has identified the appropriate aging effects for the materials and environments associated with components in the feedwater system.

Aging Management Programs

The following AMPs are utilized to manage aging effects to the feedwater system.

- Bolting Integrity Program (3.0.3.1)
- Chemistry Program (3.0.3.2)
- Flow Accelerated Corrosion Program (3.0.3.4)
- Boric Acid Corrosion Program (B.0.3.6)
- General Corrosion of External Surfaces Program (3.0.3.12)
- One-Time Inspection Program (3.0.3.13)

Each of the above AMPs is credited with managing the aging of several components in different structures and systems and are, therefore considered common AMPs. The staff review of the common AMPs is in Section 3.0.3 of this SER.

After evaluating the applicant's AMR for each of the feedwater system components, the staff evaluated the AMPs listed above to determine if they are appropriate for managing the identified aging effects. For those components identified in Table 3.4-1 of the LRA, the staff verified that the applicant credited the AMP(s) recommended by the GALL Report. For the components identified in LRA Tables 3.4-2 and 3.4-3, the staff verified that the applicant credited an AMP that is appropriate for the identified aging effect(s).

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with components in the feedwater system. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

3.4.2.4.1.3 Conclusions

The staff has reviewed the information in Sections 2.3.4 and 3.4 of the LRA, the applicant's responses to the staff's RAIs, and the applicable AMP descriptions in Appendix B of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the components in the feedwater system will be adequately managed so that these components will perform their intended functions in accordance with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR Supplement program descriptions and concludes that the USAR Supplements provide adequate program descriptions of the AMPs credited for managing aging in the feedwater system to satisfy 10 CFR 54.21(d).

3.4.2.4.2 Auxiliary Feedwater

3.4.2.4.2.1 Summary of Technical Information in the Application

The AMR results for the AFW system are presented in Tables 3.4-1, 3.4-2, and 3.4-3 of the LRA. The applicant used the GALL Report format to present its AMR of the AFW system components in LRA Table 3.4-1. In LRA Tables 3.4-2 and 3.4-3, the applicant identified the component group designation along with its (1) material, (2) environment, (3) aging effect(s), and (4) AMP(s).

As described in Section 2.3.4.2, the AFW system contains one EFWST, two pumps, plus related piping, valves, and instrumentation.

Aging Effects

LRA Tables 3.4-1 through 3.4-3 identify the following applicable aging effects for the AFW system.

- loss of material of carbon steel components due to general corrosion, pitting, and crevice corrosion in treated water
- loss of material of carbon and stainless steel components due to general corrosion, pitting, crevice corrosion, and MIC in lubricating oil possibly contaminated with water
- loss of material of carbon steel components due to general corrosion of the external surfaces in ambient air
- wall thinning of carbon steel components due to FAC in steam or treated water
- loss of material of carbon steel components due to general corrosion, crack initiation and growth due to cyclic loading in ambient air, in high-pressure or high-temperature systems or saturated steam

- loss of material of low-alloy steel components due to boric acid corrosion in ambient air, and leaking and dripping, chemically treated borated water
- loss of material of copper alloy components due to general corrosion resulting from water contamination in lubricating oil
- cracking of stainless steel components in de-oxygenated treated water or saturated steam due to exposure to sulfates or halogens
- selective leaching of copper alloy components in de-oxygenated treated water
- crevice and/or pitting corrosion of stainless steel components due to exposure to dissolved oxygen or halogens and sulfates

Aging Management Programs

The following AMPs are utilized to manage aging effects to the AFW system.

- Bolting Integrity Program (B.1.1)
- Chemistry Program (B.1.2)
- Flow Accelerated Corrosion Program (B.1.5)
- Boric Acid Corrosion Program (B.2.1)
- Periodic Surveillance and Preventive Maintenance Program (B.2.7)
- General Corrosion of External Surfaces Program (B.3.3)
- One-Time Inspection Program (B.3.5)
- Selective Leaching Program (B.3.6)

A description of these AMPs is provided in Appendix B of the LRA.

3.4.2.4.2.2 Staff Evaluation

This section of the SER provides the staff's evaluation of the applicant's AMR for the aging effects and the appropriateness of the programs credited for the aging management of the AFW system components at FCS. The staff's evaluation includes a review of the aging effects considered and the basis for the applicant's elimination of certain aging effects. In addition, the staff has evaluated the appropriateness of the AMPs that are credited for managing the identified aging effects for the AFW system components.

In addition to Section 3.4 of the LRA, the staff reviewed the pertinent information provided in Section 2.3.4, "Steam and Power Conversion Systems," and the applicable AMP descriptions provided in Appendix B of the LRA to determine whether the aging effects for the AFW system components have been properly identified and will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Aging Effects

The component groups identified in LRA Table 2.3.4.2-1 for the AFW system are (1) bolting, (2) filters/strainers, (3) flow element/orifice housing, (4) heat exchanger, (5) indicator/recorder, (6) pipes and fittings, (7) pump casings, (8) tanks, (9) transmitter element, (10) turbine casing, and (11) valve bodies. The materials used for these component groups in the AFW system are (1) steel, (2) copper alloy, (3) aluminum, and (4) glass.

Steel: For each of the carbon steel and low-alloy steel components in the AFW system, the applicant identified loss of material as an applicable aging effect. The aging mechanisms leading to loss of material for these carbon and low-alloy steel components include general corrosion, boric acid corrosion, pitting, and crevice corrosion. These aging mechanisms depend on the different environments that the steel components are exposed to such as (1) ambient air, (2) treated water, (3) borated water, and (4) saturated steam. The staff concurs with the applicant's identification of loss of material as an applicable aging effect for each of the carbon and low-alloy steel components in the AFW system.

For stainless steel pipes, fittings, and valves in the AFW system that are exposed to de-oxygenated treated water or saturated steam, the applicant identified loss of material and cracking as applicable aging effects. The applicant also identified loss of material as an applicable aging effect for the stainless steel filter/strainer, flow element/orifice housing, and pipes and fittings that are exposed to de-oxygenated treated water. For stainless steel components that are not exposed to harsh environments (i.e., ambient air), the applicant did not identify any applicable aging effects. The staff concurs with the applicant's identification of loss of material and cracking as applicable aging effects for the stainless steel components in the AFW system that are exposed to harsh environments.

Copper Alloy: Copper alloy is used for the heat exchanger, valve bodies, and pipes and fittings in the AFW system. The applicant identified loss of material due to crevice and pitting corrosion, selective leaching, and general corrosion for copper alloy exposed to de-oxygenated treated water or lubricating oil. For copper alloy exposed only to ambient air, the applicant did not identify any applicable aging effects.

LRA Table 3.4-2 states that copper alloy components operating in a de-oxygenated environment are subject to loss of material due to crevice and pitting corrosion resulting from stagnant or low-flow conditions, or due to wear from flow-induced vibration. The applicant credits the one-time inspection to manage this effect. This program is described in LRA Section B.3.5 and is evaluated in Section 3.0.3.13 of this SER. The staff issued RAI 3.4.1-10 requesting the applicant to provide justification that the one-time inspection program at FCS will provide adequate aging management for both the internal and external surfaces of the copper alloy components in the heat exchangers of the AFW system at FCS.

In its response by letter dated December 19, 2002, the applicant stated the following:

> The activities of three separate programs, namely One-time Inspection (B.3.5), Selective Leaching (B.3.6) and Periodic Surveillance and Preventive maintenance (B.2.7) are deemed to be appropriate for providing aging management that is equivalent to the GALL Report for cooling water programs.

The staff concludes that a one-time inspection identified for copper alloy components in a de-oxygenated treated water environment (LRA Table 3.4-2, row numbers 3.2.0.3 and 3.2.0.4) is not an adequate means of managing loss of material for both the internal and external surfaces of the components in that environment. Similarly, for loss of material due to selective leaching of copper alloy in a de-oxygenated treated water environment, the selective leaching program by itself, since it covers only the component internals, is not considered an adequate means of managing loss of material in that environment. By letter dated February 20, 2003, the staff issued POI-11, requesting the applicant to provide for aging management of loss of material for the external surfaces for these copper alloy components. By letter dated March 14, 2003, the applicant responded to POI-11 by stating that for components in de-oxygenated treated water, the one-time inspection and selective leaching program are credited in LRA Table 3.4-2. The chemistry program (B.1.2) has been added to LRA Table 3.4-2, row 3.4.2.03. The periodic surveillance and preventive maintenance program is credited for the lube oil side of the cooler, not the de-oxygenated treated water side.

On the basis of the additional information provided by the applicant in response to POI-11, the staff finds that the applicant has provided adequate aging management for loss of material for both internal and external environments for copper alloy components. Therefore, POI-11 is considered resolved.

Aluminum: Aluminum is used for some of the pump casings in the AFW system. For aluminum exposed to lubricating oil, the applicant identified loss of material due to general corrosion as an applicable aging effect. For aluminum exposed only to ambient air, the applicant did not identify any applicable aging effects. The staff concurs with the applicant's identification of loss of material as an applicable aging effect for aluminum pump casings exposed to lubricating oil.

Glass: Glass is used for the indicator/recorder portions of the heat exchanger. The applicant did not identify any applicable aging effects for glass. The staff concurs with this finding for glass components.

On the basis of its review, the staff finds the applicant has identified the appropriate aging effects for the materials and environments associated with the AFW system.

Aging Management Programs

The following AMPs are utilized to manage aging effects to the AFW system.

- Bolting Integrity Program (3.0.3.1)
- Chemistry Program (3.0.3.2)
- Flow Accelerated Corrosion Program (3.0.3.4)
- Boric Acid Corrosion Program (3.0.3.6)
- Periodic Surveillance and Preventive Maintenance Program (3.0.3.10)
- General Corrosion of External Surfaces Program (3.0.3.12)
- One-Time Inspection Program (3.0.3.13)
- Selective Leaching Program (3.0.3.14)

Each of the above AMPs are credited with managing the aging of several components in different structures and systems and are, therefore considered common AMPs. The staff review of the common AMPs is in Section 3.0.3 of this SER.

After evaluating the applicant's AMR for each of the AFW system components, the staff evaluated the AMPs listed above to determine if they are appropriate for managing the identified aging effects. For those components identified in Table 3.4-1 of the LRA, the staff verified that the applicant credited the AMP(s) recommended by the GALL Report. For the components identified in LRA Tables 3.4-2 and 3.4-3, the staff verified that the applicant credited an AMP that is appropriate for the identified aging effect(s).

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with the AFW system. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

3.4.2.4.2.3 Conclusions

The staff has reviewed the information in Sections 2.3.4 and 3.4 of the LRA, the applicant's responses to the staff's RAIs, and the applicable AMP descriptions in Appendix B of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the components in the AFW system will be adequately managed so that these components will perform their intended functions in accordance with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR Supplement program descriptions and concludes that the USAR Supplements provide adequate program descriptions of the AMPs credited for managing aging in the AFW system to satisfy 10 CFR 54.21(d).

3.4.2.4.3 Main Steam and Turbine Steam Extraction

3.4.2.4.3.1 Summary of Technical Information in the Application

The AMR results for the main steam and turbine steam extraction system are presented in Tables 3.4-1, 3.4-2, and 3.4-3 of the LRA. The applicant used the GALL Report format to present its AMR of the main steam and turbine steam extraction system components in LRA Table 3.4-1. In LRA Tables 3.4-2 and 3.4-3, the applicant identified the component group designation along with its (1) material, (2) environment, (3) aging effect(s), and (4) AMP(s).

Section 2.3.4.3 of the LRA provides a brief description of the portion of the main steam and turbine steam extraction system that is within the scope of license renewal and subject to an AMR. The component groupings for the main steam and turbine steam extraction system are (1) bolting, (2) filters/strainers, (3) pipes and fittings, and (4) valve bodies.

Aging Effects

The LRA identifies the following applicable aging effects for the main steam and turbine steam extraction system.

- cumulative fatigue damage of carbon steel and stainless steel components due to cyclic loading
- loss of material of carbon steel components due to general corrosion, pitting, and crevice corrosion in treated water
- loss of material of carbon and stainless steel components due to general corrosion, pitting, crevice corrosion, and MIC in lubricating oil possibly contaminated with water
- loss of material of carbon steel components due to general corrosion of the external surfaces in ambient air
- wall thinning of carbon steel components due to FAC in saturated steam or treated water
- loss of material of carbon steel components due to general corrosion, crack initiation, and growth due to cyclic loading in ambient air, in high-pressure or high-temperature systems, or saturated steam
- loss of material of low-alloy steel components due to boric acid corrosion in ambient air and leaking and dripping, chemically treated borated water
- loss of material of copper alloy components due to general corrosion resulting from water contamination in lubricating oil
- cracking of stainless steel components in de-oxygenated treated water or saturated steam due to exposure to sulfates or halogens
- selective leaching of copper alloy components in de-oxygenated treated water.
- crevice and/or pitting corrosion of stainless steel components due to exposure to dissolved oxygen, or halogens and sulfates

Aging Management Programs

The following AMPs are utilized to manage aging effects to the main steam and turbine steam extraction system.

- Bolting Integrity Program (B.1.1)
- Chemistry Program (B.1.2)
- Flow Accelerated Corrosion Program (B.1.5)
- Boric Acid Corrosion Program (B.2.1)
- Periodic Surveillance and Preventive Maintenance Program (B.2.7)
- General Corrosion of External Surfaces Program (B.3.3)
- One-Time Inspection Program (B.3.5)
- TLAA evaluated in accordance with 10 CFR 54.21(c)

A description of these AMPs is provided in Appendix B of the LRA.

3.4.2.4.3.2 Staff Evaluation

This section of the SER provides the staff's evaluation of the applicant's AMR for the aging effects and the appropriateness of the programs credited for the aging management of the main steam and turbine steam extraction system components at FCS. The staff's evaluation includes a review of the aging effects considered and the basis for the applicant's elimination of certain aging effects. In addition, the staff has evaluated the appropriateness of the AMPs that are credited for managing the identified aging effects for the main steam and turbine steam extraction system components.

In addition to Section 3.4 of the LRA, the staff reviewed the pertinent information provided in Section 2.3.4, "Steam and Power Conversion Systems," and the applicable AMP descriptions provided in Appendix B of the LRA to determine whether the aging effects for the main steam and turbine steam extraction system components have been properly identified and will be adequately managed during the period of extended operation as required by 10 CFR 54.21(a)(3).

Aging Effects

The component groups identified in LRA Table 2.3.4.3-1 for the main steam and turbine steam extraction system are (1) bolting, (2) filters/strainers, (3) pipes and fittings, and (4) valve bodies. The materials used for these component groups are carbon steel and stainless steel.

For carbon steel components in the main steam and turbine steam extraction system, the applicant identified loss of material and cumulative fatigue as applicable aging effects. The aging mechanisms leading to loss of material include (1) general corrosion, (2) wall thinning, (3) boric acid corrosion, (4) pitting, and (5) crevice corrosion. These different aging mechanisms are dependant on the local environment to which the carbon steel components are subjected. These environments include (1) ambient air, (2) borated water, (3) saturated steam, and (4) treated water.

For carbon steel piping and valve bodies in treated water and saturated steam (LRA Table 3.4-1, row entry 3.4.1.06), the applicant credits the FAC program, which is consistent with the GALL Report. However, the applicant also uses the FAC program for carbon steel filter/strainer, pipes and fittings, and valve bodies exposed to saturated steam (LRA Table 3.4-3, row entry 3.4.3.04). In RAI 3.4.1-8, the staff requested that the applicant clarify the use of LRA Table 3.4-

3 for carbon steel piping and valve bodies in treated water. In response, the applicant stated that the link to row entry 3.4.3.04 for carbon steel components exposed to saturated steam is for the filters/strainers since they are not specifically addressed in the GALL Report. The applicant also clarified that all the in-scope piping in the main steam and turbine steam extraction system is included in the FAC program. The staff finds that the applicant's response to RAI 3.4.1-8 is adequate since it explains the aging management for carbon steel piping exposed to saturated steam.

For stainless steel components in the main steam and turbine steam extraction system that are exposed to de-oxygenated treated water or saturated steam, the applicant identified loss of material and cracking as applicable aging effects. For stainless steel components in ambient air the applicant did not identify any applicable aging effects.

The staff concurs with the applicant's identification of loss of material, cracking, and cumulative fatigue as applicable aging effects for steel components in the main steam and turbine steam extraction system. The staff finds that the applicant has adequately identified the applicable aging effects for these carbon and stainless steel components.

Aging Management Programs

The following AMPs are utilized to manage aging effects to the main steam and turbine steam extraction system.

- Bolting Integrity Program (3.0.3.1)
- Chemistry Program (3.0.3.2)
- Flow Accelerated Corrosion Program (3.0.3.4)
- Boric Acid Corrosion Program (3.0.3.6)
- Periodic Surveillance and Preventive Maintenance Program (3.0.3.10)
- General Corrosion of External Surfaces Program (3.0.3.12)
- One-Time Inspection Program (3.0.3.13)
- TLAA evaluated in accordance with 10 CFR 54.21(c)

Each of the above AMPs is credited with managing the aging of several components in different structures and systems and are, therefore considered common AMPs. The staff's review of the common AMPs is in Section 3.0.3 of this SER.

After evaluating the applicant's AMR for each of the main steam and turbine steam extraction system components, the staff evaluated the AMPs listed above to determine if they are appropriate for managing the identified aging effects. For those components identified in Table 3.4-1 of the LRA, the staff verified that the applicant credited the AMP(s) recommended by the GALL Report. For the components identified in Tables 3.4-2 and 3.4-3, the staff verified that the applicant credited an AMP that is appropriate for the identified aging effect(s).

In RAI 3.4.3-1, the staff requested that the applicant provide further information concerning the management of loss of material due to FAC for the carbon steel filter/strainer components in the main steam and turbine steam extraction system that are exposed to saturated steam. Specifically, the staff noted that the geometry and hydrodynamic conditions of filters and strainers are substantially different from piping/fittings and valve bodies for which the FAC program is normally used. In response to RAI 3.4.3-1, the applicant stated the following:

> There are no known analytical tools that can accurately model and predict the corrosion rates in strainer or valve bodies. The FAC Program uses the corrosion rates on the downstream piping as a

> qualitative indicator of the corrosion rates in the strainer or valve bodies to determine inspection and verification requirements for the valve or strainer body in this case. This is a conservative approach since the bodies of the components are much thicker than the piping. Additionally the ability to ultrasonically test valve bodies or strainer bodies is very limited so any components that are identified as having a high corrosion rate will be disassembled and visually inspected.

The staff finds the applicant's response reasonable and acceptable because it explains how the FAC program will be used for the filters and strainers. Therefore, RAI 3.4.3-1 is considered resolved.

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with the main steam and turbine steam extraction system. In addition, the staff found the associated program and TLAA descriptions in the USAR Supplements to be acceptable to satisfy 10 CFR 54.21(d).

3.4.2.4.3.3 Conclusions

The staff has reviewed the information in Sections 2.3.4 and 3.4 of the LRA, the applicant's responses to the staff's RAIs, and the applicable AMP descriptions in Appendix B of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the components in the main steam and turbine steam extraction system will be adequately managed so that these components will perform their intended functions in accordance with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR Supplement program descriptions and concludes that the USAR Supplements provide adequate program descriptions of the AMPs credited for managing aging in the main steam and turbine steam extraction system to satisfy 10 CFR 54.21(d).

3.4.3 Evaluation Findings

The staff has reviewed the information in Section 3.4 of the LRA. On the basis of its review, the staff concludes that the applicant has demonstrated that the aging effects associated with the steam and power conversion systems will be adequately managed so that these systems will perform their intended functions in accordance with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR Supplement program descriptions and concludes that the USAR Supplements provide adequate program descriptions of the AMPs credited for managing aging in the steam and power conversion systems to satisfy 10 CFR 54.21(d).

3.5 Containment, Structures, and Component Supports

This section addresses the aging management of structural components. The components in these structures that make up this group are described in the following SER sections:

- Containment (2.4.1)
- Auxiliary Building (2.4.2.1)
- Turbine Building and Service Building (2.4.2.2)
- Intake Structure (2.4.2.3)
- Building Piles (2.4.2.4)
- Fuel Handling Equipment and Heavy Load Cranes (2.4.2.5)

- Component Supports (2.4.2.6)
- Duct Banks (2.4.2.7)

As discussed in Section 3.0.1 of this SER, the structural components are included in one of three LRA tables. LRA Table 3.5-1 consists of structural components that are evaluated in the GALL Report, LRA Table 3.5-2 consists of structural components that are not evaluated in the GALL Report, and LRA Table 3.5-3 consists of structural components that are not evaluated in the GALL Report, but the applicant has determined can be managed using a GALL AMR and associated AMP.

3.5.1 Summary of Technical Information in the Application

In LRA Section 3.5, the applicant described its AMR for structural components within the containment, other Class I structures, and component supports at FCS. The passive, long-lived components in these structures that are subject to an AMR are identified in LRA Tables 2.4.1-1 and 2.4.2.1-1 through 2.4.2.7-1.

The applicant's AMRs included an evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify aging effects that require management. These reviews concluded that the aging effects requiring management, based on FCS operating experience, were consistent with aging effects identified in GALL. The applicant's review of industry operating experience included a review of operating experience through 2001. The results of this review concluded that aging effects requiring management based on industry operating experience were consistent with aging effects identified in GALL. The applicant's ongoing review of plant-specific and industry operating experience is conducted in accordance with the FCS operating experience program.

3.5.2 Staff Evaluation

In Section 3.5 of the LRA, the applicant described its AMR for structural components at FCS. The staff reviewed LRA Section 3.5 to determine whether the applicant has provided sufficient information to demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB throughout the period of extended operation, in accordance with the requirements of 10 CFR 54.21(a)(3), for structural components that are determined to be within the scope of license renewal and subject to an AMR.

The applicant referenced the GALL Report in its AMR. The staff has previously evaluated the adequacy of the aging management of structural components for license renewal as documented in the GALL Report. Thus, the staff did not repeat its review of the items described in the GALL Report, except to ensure that the material presented in the LRA was applicable, and to verify that the applicant had identified the appropriate aging management programs as described and evaluated in the GALL Report.

The staff evaluated those aging management issues recommended for further evaluation in the GALL Report as well as the applicant's AMR for structural components that are not addressed in the GALL Report. In addition, the staff evaluated the AMPs used by the applicant to manage the aging of structural components. Finally, the staff reviewed the structural components listed in the tables in LRA Section 2.4 to determine whether the applicant properly identified the applicable aging effects and AMPs needed to adequately manage the aging effects.

Table 3.5-1 below provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.5 that are addressed in the GALL Report.

Table 3.5-1

Staff Evaluation for FCS Structures and Structural Components in the GALL Report

Common Components of All Types of PWR and BWR Containment

Component Group	Aging Effect/Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Penetration sleeves penetration bellows, and dissimilar metal welds	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA evaluated in accordance with 10 CFR 54.21(c)	TLAA (4.6)	Consistent with GALL. GALL recommends further evaluation (See Section 3.5.2.2.1.6 below)
Penetration sleeves, bellows, and dissimilar metal welds	Cracking due to cyclic loading, or crack initiation and growth due to SCC	Containment ISI and Containment leak rate test	Containment Inservice Inspection Program (B.1.3) and Containment Leak Rate Program (B.1.4)	Consistent with GALL. GALL recommends further evaluation (See Section 3.5.2.2.1.7 below)
Penetration sleeves, penetration bellows, and dissimilar metal welds	Loss of material due to corrosion	Containment ISI and Containment leak rate test	Containment Inservice Inspection Program (B.1.3) and Containment Leak Rate Program (B.1.4)i	Consistent with GALL. (See Section 3.5.2.1 below)
Personnel airlock and equipment hatch	Loss of material due to corrosion	Containment ISI and Containment leak rate test	Containment Inservice Inspection Program (B.1.3) and Containment Leak Rate Program (B.1.4)	Consistent with GALL. (See Section 3.5.2.1 below)
Personnel airlock and equipment hatch	Loss of leak tightness in closed position due to mechanical wear of locks, hinges and closure mechanism	Containment leak rate test and Plant Technical Specifications	Containment Inservice Inspection Program (B.1.3) and Containment Leak Rate Program (B.1.4)	Consistent with GALL. (See Section 3.5.2.1 below)
Seals, gaskets, and moisture barriers	Loss of sealant and leakage through containment due to deterioration of joint seals, gaskets, and moisture barriers	Containment ISI and Containment leak rate test	Containment Inservice Inspection Program (B.1.3) and Containment Leak Rate Program (B.1.4)	Consistent with GALL. (See Section 3.5.2.1 below)

PWR Concrete (Reinforced and Prestressed) and Steel Containment
BWR Concrete (Mark II and III) and Steel (Mark I, II, and III) Containment

Component Group	Aging Effect/Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Concrete elements: foundation, walls, dome.	Aging of accessible and inaccessible concrete areas due to leaching of calcium hydroxide, aggressive chemical attack, and corrosion of embedded steel	Containment ISI	Containment Inservice Inspection Program (B.1.3)	Consistent with GALL. GALL recommends further evaluation (See Section 3.5.2.2.1.1 below)
Concrete elements: foundation	Cracks, distortion, and increases in component stress level due to settlement	Structures Monitoring	Structures Monitoring Program (B.2.10)	Consistent with GALL. (See Section 3.5.2.2.1.2 below)
Concrete elements: foundation	Reduction in foundation strength due to erosion of porous concrete subfoundation	Structures Monitoring	Structures Monitoring Program (B.2.10)	Consistent with GALL. (See Section 3.5.2.2.1.2 below)
Concrete elements: foundation, dome, and wall	Reduction of strength and modulus due to elevated temperature	Plant specific	None	Consistent with GALL. GALL recommends further evaluation (See Section 3.5.2.2.1.3 below)
Prestressed containment: tendons and anchorage components	Loss of prestress due to relaxation, shrinkage, creep, and elevated temperature	TLAA evaluated in accordance with 10 CFR 54.21(c)	TLAA (4.5)	Consistent with GALL. GALL recommends further evaluation (See Section 3.5.2.2.1.5 below)
Steel elements: liner plate, containment shell	Loss of material due to corrosion in accessible and inaccessible areas	Containment ISI and Containment leak rate test	Containment Inservice Inspection Program (B.1.3) and Containment Leak Rate Program (B.1.4)	Consistent with GALL. GALL recommends further evaluation (See Section 3.5.2.2.1.4 below)
Steel elements: vent header, drywell head, torus, downcomers, pool shell	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA evaluated in accordance with 10 CFR 54.21(c)	None	BWR
Steel elements: protected by coating	Loss of material due to corrosion in accessible areas only	Protective coating monitoring and maintenance	None	Not Applicable to FCS
Prestressed containment: tendons and anchorage components	Loss of material due to corrosion of prestressing tendons and anchorage components	Containment ISI	Containment Inservice Inspection Program (B.1.3)	Consistent with GALL. (See Section 3.5.2.1 below)
Concrete elements: foundation, dome, and wall	Scaling, cracking, and spalling due to freeze-thaw; expansion and cracking due to reaction with aggregate	Containment ISI	Containment Inservice Inspection Program (B.1.3)	Consistent with GALL. (See Section 3.5.2.1 below)
Steel elements: vent line bellows, vent headers, downcomers	Cracking due to cyclic loads or Crack initiation and growth due to SCC	Containment ISI and Containment leak rate test	None	BWR
Steel elements: Suppression chamber liner	Crack initiation and growth due to SCC	Containment ISI and Containment leak rate test	None	BWR

Steel elements: drywell head and downcomer pipes	Fretting and lock up due to wear	Containment ISI	None	BWR

Class I Structures

Component Group	Aging Effect/Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
All Groups except Group 6: accessible interior/exterior concrete & steel components	All types of aging effects	Structures Monitoring	Structures Monitoring Program (B.2.10)	Consistent with GALL. (See Section 3.5.2.2.2.1 below)
Groups 1-3, 5, 7-9: inaccessible concrete components, such as exterior walls below grade and foundation	Aging of inaccessible concrete areas due to aggressive chemical attack, and corrosion of embedded steel	Plant-specific	None	Consistent with GALL. GALL recommends further evaluation (See Section 3.5.2.2.2.2 below)
Group 6: all accessible/inaccessible concrete, steel and earthen components	All types of aging effects, including loss of material due to abrasion, cavitation, and corrosion	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance	None	Not Applicable to FCS
Group 5: liners	Crack initiation and growth from SCC and loss of material due to crevice corrosion	Water Chemistry Program and Monitoring of spent fuel pool water level	Chemistry Program (B.1.2) Periodic Surveillance and Preventive Maintenance Program (B.2.7)	Consistent with GALL. (See Section 3.5.2.1 below)
Group 1-3, 5, 6: all masonry block walls	Crack due to restraint, shrinkage, creep, and aggressive environment	Masonry Wall	Structures Monitoring Program (B.2.10)	Consistent with GALL. (See Section 3.5.2.1 below)
Group 1-3, 5, 7-9: foundation	Cracks, distortion, and increases in component stress level due to settlement	Structures Monitoring	Structures Monitoring Program (B.2.10)	Consistent with GALL. (See Section 3.5.2.2.1.2 below)
Group 1-3, 5-9: foundation	Reduction in foundation strength due to erosion of porous concrete subfoundation	Structures Monitoring	Structures Monitoring Program (B.2.10)	Consistent with GALL. (See Section 3.5.2.2.1.2 below)
Group 1-5: concrete	Reduction of strength and modulus due to elevated temperature	Plant-specific	None	Consistent with GALL. GALL recommends further evaluation (See Section 3.5.2.2.1.3 below)
Groups 7, 8: liners	Crack initiation and growth due to SCC; Loss of material due to crevice corrosion	Plant-specific	None	Not Applicable to FCS

Component Supports

Component Group	Aging Effect/Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
All Groups: support members: anchor bolts, concrete surrounding anchor bolts, welds, grout pad, bolted connections, etc.	Aging of component support	Structures Monitoring	Structures Monitoring Program (B.2.10)	Consistent with GALL. (See Section 3.5.2.2.3.1 below)
Groups B1.1, B1.2, and B1.3: support members: anchor bolts, welds	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA evaluated in accordance with 10 CFR 54.21(c)	Not Applicable	Consistent with GALL. GALL recommends further evaluation (See Section 3.5.2.2.3.2 below)
All Groups: support members: anchor bolts, welds	Loss of material due to boric acid corrosion	Boric acid corrosion	Boric Acid Corrosion Prevention Program (B.2.1)	Consistent with GALL. (See Section 3.5.2.1 below)
Groups B1.1, B1.2, and B1.3: support members: anchor bolts, welds, spring hangers, guides, stops, and vibration isolators	Loss of material due to environmental corrosion; loss of mechanical function due to corrosion, distortion, dirt, overload, etc.	ISI	Inservice Inspection Program (B.1.7)	Consistent with GALL. (See Section 3.5.2.1 below)
Group B1.1: high strength low-alloy bolts	Crack initiation and growth due to SCC	Bolting integrity	Bolting Integrity Program (B.1.1)	Consistent with GALL. (See Section 3.5.2.1 below)

The staff's review of the structural components for the FCS LRA is contained within four sections of this SER. Section 3.5.2.1 is the staff review of structures and structural components that the applicant indicates are consistent with GALL and do not require further evaluation. Section 3.5.2.2 is the staff review of structures and structural components that the applicant indicates are consistent with GALL and for which GALL recommends further evaluation. Section 3.5.2.3 is the staff evaluation of the AMPs that are specific to the aging management of structural components. Section 3.5.2.4 contains an evaluation of the adequacy of aging management for components in each structure and includes an evaluation of structures and structural components that the applicant indicates are not in GALL.

3.5.2.1 Aging Management Evaluations in the GALL Report That Are Relied on for License Renewal, Which Do Not Require Further Evaluation

For component groups evaluated in GALL for which the applicant claimed consistency with GALL, and for which GALL does not recommend further evaluation, the staff sampled components in these groups during the AMR inspection to determine whether the plant-specific components contained in these GALL component groups are bounded by the GALL evaluation. The staff also sampled component groups during the AMR inspection to determine whether the applicant properly identified those component groups in GALL that are not applicable to its plant. The results of the staff's AMR inspection can be found in AMR Inspection Report 50-285/03-07, dated March 20, 2003.

On the basis of its review of the inspection results, the staff finds that the applicant's claim of consistency with GALL is acceptable, and that it is acceptable for the applicant to reference the information in the GALL Report for structures and structural components. Therefore, on this basis, the staff concludes that the applicant has demonstrated that the components for which the applicant claimed consistency with GALL 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) and that the USAR Supplement provides an adequate summary description of the programs and activities credited for managing the effects of aging for the ESF system components for which the applicant claimed consistency with GALL, as required by 10 CFR 54.21(d).

3.5.2.2 Aging Management Evaluations in the GALL Report that Are Relied on for License Renewal, For Which GALL Recommends Further Evaluation

For component groups evaluated in GALL for which the applicant has claimed consistency with GALL, and for which GALL recommends further evaluation, the staff reviewed the applicant's evaluation to determine whether it adequately addressed the issues for which GALL recommends further evaluation. In addition, the staff sampled components in these groups during the AMR inspection to determine whether the plant-specific components contained in these GALL component groups were bounded by the GALL evaluation. The results of the staff's AMR inspection can be found in AMR Inspection Report 50-285/03-07, dated March 20, 2003.

The GALL Report indicates that further evaluation should be performed for the following structures.

3.5.2.2.1 Containment

3.5.2.2.1.1 Aging of Inaccessible Concrete Areas

As stated in the SRP-LR, the GALL Report recommends further evaluation to manage the aging effects for containment concrete components located in inaccessible areas, if the aging mechanisms (1) leaching of calcium hydroxide, (2) aggressive chemical attack, or (3) corrosion of embedded steel are significant. Possible aging effects for containment concrete structural components due to these three aging mechanisms are cracking, change in material properties, and loss of material.

The AMP recommended by the GALL Report for managing the above aging effects for containment concrete components in accessible portions of the containment structures is the ASME Section XI, Subsection IWL (XI.S2) program. The staff's evaluation of the applicant's ASME Section XI, Subsection IWL AMP is found in Section 3.0.3.3 of this SER.

Subsection IWL exempts from examination those portions of the concrete containment that are inaccessible (e.g., foundation, below-grade exterior walls, concrete covered by liner). For inaccessible portions of the containment structure, 10 CFR 50.55a(b)(2)(ix) requires that the licensee evaluate the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to inaccessible areas.

In LRA Table 3.5-1, the applicant addressed the specific criteria defined in the GALL Report regarding the need for further evaluation to manage the potential aging of containment concrete structural components in inaccessible areas. The GALL Report recommends further evaluation for containment concrete in inaccessible areas if the aging mechanisms (1) leaching of calcium hydroxide, (2) aggressive chemical attack, or (3) corrosion of embedded steel are significant. Regarding the aging mechanism leaching of calcium hydroxide, the applicant stated the following in LRA Table 3.5-1:

> Leaching of calcium hydroxide from reinforced concrete becomes significant only if the concrete is exposed to flowing water. The reinforced concrete at FCS is not exposed to flowing water.

Regarding the aging mechanism's aggressive chemical attack and corrosion of embedded steel, the applicant stated the following in LRA Table 3.5-1:

> Below-grade exterior reinforced concrete at FCS is not exposed to an aggressive environment (pH less than 5.5), or to chloride or sulfate solutions beyond defined limits (greater than 500 ppm chloride, or greater than 1500 ppm sulfate).

Since the below-grade reinforced concrete at FCS is not exposed to an aggressive environment, the staff agrees with the applicant's conclusion that the aging mechanisms aggressive chemical attack and corrosion of embedded steel are not likely to be significant. In addition, since the below-grade reinforced concrete at FCS is not exposed to flowing water, the staff concludes that leaching of calcium hydroxide from reinforced concrete is probably not significant. Since these three aging mechanisms are not significant for below-grade reinforced concrete at FCS, the further evaluation recommended by the GALL Report is not warranted. Further discussion regarding the aging management of inaccessible containment concrete components is found in Section 3.5.2.4.1 of this SER.

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of aging of inaccessible concrete areas for the containment, as recommended in the GALL Report.

3.5.2.2.1.2 Cracking, Distortion, and Increase in Component Stress Level Due to Settlement; Reduction of Foundation Strength Due to Erosion of Porous Concrete Subfoundations, If Not Covered by Structures Monitoring Program

As stated in the SRP-LR, for the containment foundation, the GALL Report recommends further evaluation of cracking due to settlement and change in material properties as manifested by a reduction of foundation strength due to erosion of the porous concrete subfoundation, if these two effects are not covered by a structures monitoring AMP. In addition, the GALL Report recommends verification of the continued functionality of a de-watering system during the license renewal period, if relied on by the applicant to lower the site ground water level.

In LRA Table 3.5-1, the applicant addressed the above criteria defined in the GALL Report regarding the need for further evaluation to manage the potential aging of the containment foundation. In row entries 3.5.1.08, 3.5.1.09, 3.5.1.21, and 3.5.1.22 of LRA Table 3.5-1, the applicant stated that it will use the SMP to manage cracking and change in material properties as manifested by a reduction in strength for the containment foundation. The staff's evaluation of the applicant's SMP is found in Section 3.0.3.11 of this SER.

Regarding cracking due to settlement, the applicant stated the following in LRA Table 3.5-1:

> The structures at FCS are supported on end-bearing steel pipe piles driven to bedrock. Settlement of the concrete subfoundation is not a plausible aging mechanism. A de-watering system is not relied upon for control of settlement at FCS.

Regarding change in material properties as manifested by a reduction in strength, the applicant stated the following in LRA Table 3.5-1:

> The reinforced concrete at FCS is not exposed to flowing water and a de-watering system is not relied upon for control of erosion of cement from porous concrete subfoundations.

Since the applicant is managing cracking and change in material properties for the containment foundation as recommended by the GALL Report, the staff finds that the applicant has adequately addressed this further evaluation criteria.

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of cracking, distortion, and increase in component stress level due to settlement; and reduction of foundation strength due to erosion of porous concrete subfoundations for containment components, as recommended in the GALL Report.

3.5.2.2.1.3 Reduction of Strength and Modulus of Concrete Structures Due to Elevated Temperature

As stated in the SRP-LR, for the containment structure, the GALL Report recommends further evaluation to manage the change in material properties as manifested by a reduction in strength and modulus, if any portion of the containment concrete exceeds the temperature limit of 150 °F. The GALL Report notes that the implementation of Subsection IWL examinations and 10 CFR 50.55a would not be able to detect the reduction of concrete strength and modulus due to elevated temperature and also notes that no mandated aging management exists for managing this aging effect.

The GALL Report recommends that a plant-specific evaluation be performed if any portion of the concrete containment components exceeds specified temperature limits, viz., general temperature 66 °C (150 °F) and local area temperature 93 °C (200 °F). The staff verified that the applicant's discussion in the renewal application indicates that the affected PWR containment components are not exposed to temperatures that exceed the above temperature limits.

In LRA Table 3.5-1, the applicant addressed the above criterion defined in the GALL Report regarding the need for further evaluation. In row entries 3.5.1.10 and 3.5.1.23 of LRA Table 3.5-1, the applicant stated the following regarding temperatures within the containment structure:

> The maximum indoor plant temperature is 120 °F inside the main area of containment. This is below the temperature limit of 150 °F. Per USAR Section 5.5.4, sleeve radiation fins and thermal sleeves (in conjunction with pipe insulation) are used to limit maximum temperature at the containment penetration sleeves to 150 °F under operating conditions.
>
> The nuclear detector well cooling system cools the out-of-core neutron detectors, which are located in tubes or wells in the reactor compartment annulus between the lower portion of the reactor vessel and the biological shield, and maintains the shield concrete temperature below 150 °F. Technical Specification Limiting Condition for Operation 2.13 requires that the annulus exit temperature from the nuclear detector cooling system shall not exceed a temperature found to correlate to 150 °F concrete temperature. Therefore, no portions of concrete containment exceed specified temperature limits and no aging management is required.

By letter dated October 11, 2002, the staff issued RAI 3.5.1-3, requesting further information regarding the correlation between the annulus exit temperature from the nuclear detector cooling system and the concrete temperature. By letter dated December 19, 2002, the applicant responded to this RAI, stating the following:

> The Nuclear Detector Cooling System is used to cool the air in the annulus between the reactor vessel and the biological shield. While the nuclear detectors can withstand temperatures considerably higher than 150 °F, the elevated temperature could result in reduction in concrete strength through loss of moisture. Each nuclear detector well cooling unit is rated at 100% of the system design capability of 173,000 Btu/hr. A test was performed during Hot Functional and/or Low Power Tests to determine

> (1) the correlation between annulus air temperature and concrete temperature, and (2) the rate at which the concrete will heat up if no cooling is available. The results of these tests were used to provide control room indication of concrete temperatures (that is annulus air temperature) and allowable reactor operation time in the event both nuclear detector well cooling units were inoperable. The objective for this specification is to hold the concrete bulk temperature to no greater than 150 °F. Temperature sensors are installed in the concrete and in the annulus air discharge. The sensors in the concrete are subjected to neutron flux during operation and are no longer functional. The indicated values for annulus exit temperatures which correlate with concrete temperatures were determined, including a maximum value used to comply with the Tech Spec limit. A reanalysis was performed in 1987 to verify the original data obtained in 1973.

The staff finds that the monitoring of the concrete temperature of the biological shield wall is acceptable since the applicant has adequate procedures for ensuring that the concrete temperature will be no greater than 150 °F. As such, the applicant's response to RAI 3.5.1-3 is acceptable.

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the reduction of strength and modulus of concrete structures due to elevated temperatures for containment concrete, as recommended in the GALL Report. Since temperatures within the containment structure have not exceeded the 150 °F limit, the staff concurs with the applicant's conclusion that further evaluation, as recommended by the GALL Report, is not required.

3.5.2.2.1.4 Loss of Material Due to Corrosion in Inaccessible Areas of Steel Containment Shell or Liner Plate

As stated in the SRP-LR, the GALL Report recommends further evaluation to manage loss of material due to corrosion for the embedded containment liner, if corrosion of the embedded liner is significant. The AMP recommended by the GALL Report for managing loss of material for accessible steel elements within the containment structure is the ASME Section XI, Subsection IWE (XI.S1) program. The staff's evaluation of the applicant's ASME Section XI, Subsection IWE AMP is found in Section 3.0.3.3 of this SER.

Subsection IWE exempts from examination portions of the containments that are inaccessible, such as embedded or inaccessible portions of steel liners and steel containment shells, piping, and valves penetrating or attaching to the containment. To cover inaccessible areas, 10 CFR 50.55a(b)(2)(ix) requires that the licensee evaluate the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to inaccessible areas.

In LRA Table 3.5-1, the applicant addressed the above criterion defined in the GALL Report, regarding the need for further evaluation to manage the potential aging of the embedded containment liner. In row entry 3.5.1.12 of LRA Table 3.5-1, the applicant stated the following regarding the potential for significant corrosion of the embedded steel containment liner:

> Corrosion for inaccessible areas (embedded containment liner) is not significant because:
>
> a. Concrete meeting the requirements of ACI 318 or 349 and the guidance of 201.2R was used for the containment concrete in contact with the embedded containment liner.
>
> b. 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.
>
> c. The moisture barrier, at the junction where the shell or liner becomes embedded, is subject to aging management activities in accordance with IWE requirements.

d. Borated water spills and water ponding on the containment concrete floor are not common and when detected are cleaned up in a timely manner.

In RAI 3.5.1-10, the staff requested further information regarding the applicant's assertions in items (b), (c), and (d) above. Specifically, the staff requested further information regarding the applicant's previous monitoring, with respect to these three items, of the containment liner and moisture barrier. In its response, the applicant stated the following:

> Review of historical and recent maintenance and corrective action documents did not identify any anomalies which could lead to significant corrosion of the inaccessible areas of the FCS containment liner plates. The most recent inspection of the containment liner and moisture barrier was performed in April 2001 to satisfy ASME Section XI IWE requirements. The inspection identified some areas of corrosion on the liner near the moisture barrier and some separation and trenching of the moisture barrier. Repairs were made to the moisture barrier during the 2002 refueling outage. This included removal of the top portion of the moisture barrier to inspect inaccessible sections of the liner. Only minor surface corrosion was found on the liner extending only 1/8" to 1/4" below the top of the existing joint sealer. Repairs were performed to recoat the liner and restore the moisture barrier. Containment inspections performed under the FCS Containment Inservice Inspection Program and Structures Monitoring Program will ensure the integrity of the liner is maintained. Additional information on the liner inspection results is included in the response to RAI B.1.3-1.

Since the applicant's inspection did not find significant corrosion in the inaccessible portion of the containment liner plates, and since the applicant credits its ASME Section XI, Subsection IWE, AMP for managing loss of material for the accessible portion of the containment liner plate, the staff finds that the applicant's response to RAI 3.5.1-10 to be acceptable. As required by 10 CFR 50.55a(b)(2)(ix), the applicant will inspect the inaccessible portions of the containment liner plates if significant corrosion of the accessible portions of the liner plate is observed.

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of the loss of material due to corrosion in inaccessible areas of the steel containment shell or liner plate for structures and structural components, as recommended in the GALL Report. Since the corrosion of the embedded steel containment liner is not significant, the further evaluation recommended by the GALL Report is not warranted.

3.5.2.2.1.5 Loss of Prestress Due to Relaxation, Shrinkage, Creep, and Elevated Temperature

As stated in the SRP-LR, the GALL Report identifies loss of prestress due to relaxation, shrinkage, creep, and elevated temperature for prestressed containment tendons and anchorage components as a TLAA to be performed for the period of extended operation. The applicant discussed this TLAA in Section 4.5 of the application and the staff evaluation of this TLAA is addressed in Section 4.5 of this SER.

3.5.2.2.1.6 Cumulative Fatigue Damage

As stated in the SRP-LR, the GALL Report identifies cumulative fatigue damage as a TLAA for penetration sleeves, penetration bellows, and dissimilar metal welds for the period of extended operation. The applicant discussed this TLAA in Section 4.6 of the application and the staff evaluation of this TLAA is addressed in Section 4.6 of this SER.

3.5.2.2.1.7 Cracking due to Cyclic Loading and SCC

As stated in the SRP-LR, the GALL Report recommends further evaluation of the AMPs to manage cracking of containment penetrations (including penetration sleeves, penetration bellows, and dissimilar metal welds) due to cyclic loading or SCC for all types of PWR containments. Containment ISI and leak rate testing may not be sufficient to detect cracks. The staff evaluated the applicant's proposed programs to verify that adequate inspection methods will be implemented to ensure that cracking of containment penetrations is detected.

In LRA Table 3.5-1, the applicant addressed the further evaluation recommendations in the GALL Report with regard to cracking of containment penetrations in LRA Table 3.5-1. In row entry 3.5.1.02 of LRA Table 3.5-1, the applicant stated the following with regard to cracking due to cyclic loading or SCC:

> Stress corrosion cracking for stainless steel bellows with dissimilar metal welds is applicable only if the susceptible material is exposed to a corrosive environment. The bellows at FCS are not exposed to a corrosive environment; therefore, SCC is not an aging effect requiring management.

In RAI 3.5.1-9, the staff requested that the applicant clarify the above conclusion regarding the susceptibility of bellows to SCC in a non-corrosive environment. In addition, the staff requested the applicant to provide further detail regarding the aging management of cracking of containment penetrations in general. Specifically, the staff requested the applicant to state whether ASME Section XI, Subsection IWE examination categories E-B (visual VT-1) and E-F (surface) of FCS bellows and dissimilar metal welds will be implemented during the period of extended operation. In its response to RAI 3.5.1-9, the applicant stated the following:

> Cracking due to cyclic loading of these bellows will be managed, per LRA AMR Item 3.5.1.02 (based on GALL Report Items II.A3.1-c and -d), by the containment ISI (B.1.3) and leak rate (B.1.4) programs which are consistent with programs XI.S1 and XI.S4 outlined in the GALL Report (i.e., the visual examination categories identified in the RAI are included in the credited programs).
>
> Relative to SCC, however, GALL Report Item II.A3.1-d identifies that "In the case of bellows assemblies, SCC may cause aging effects particularly if the material is not shielded from a corrosive environment." For stainless steel, the corrosive environment needed for SCC to occur is a high-temperature, wetted, chloride environment (see response to RAI 3.2.1-2). At FCS, the bellows are normally in an air environment. There are no bolted connections near these bellows assemblies that could result in leakage that would provide the necessary environmental conditions. LRA AMR Item 3.5.1.02 Discussion column, Item 4 is based on these operating parameter assumptions.

The staff finds the applicant's response to RAI 3.5.1-9 to be adequate since the ASME Section XI, Subsection IWE examination categories E-B (visual VT-1) and E-F (surface) of FCS bellows and dissimilar metal welds will be implemented during the period of extended operation. In addition, since the bellow assemblies are not exposed to a corrosive environment, the staff finds that cracking due to SCC is unlikely. However, the staff notes that cracking will be managed by the applicant's containment ISI and containment leak rate AMPs.

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of cracking of containment penetrations (including penetration sleeves, penetration bellows, and dissimilar metal welds) due to cyclic loading and SCC, as recommended in the GALL Report. A complete review of the applicant's containment ISI and containment leak rate AMPs can be found in Sections 3.0.3.3 and 3.5.2.3.1, respectively, of this SER.

3.5.2.2.1.8 Conclusions

The staff has reviewed the applicant's evaluation of the issues for which GALL recommends further evaluation for the containment structural components. On the basis of its review, the staff finds that the applicant has provided sufficient information to demonstrate that the issues for which GALL recommends further evaluation have been adequately addressed and that the subject aging effects will be adequately managed for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the USAR Supplements for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for containment components for which the applicant claimed consistency with GALL to satisfy 10 CFR 54.21(d).

3.5.2.2.2 Class I Structures

3.5.2.2.2.1 Aging of Structures Not Covered by Structures Monitoring Program

As stated in the SRP-LR, the GALL Report recommends further evaluation for certain structure/aging effect combinations, if they are not covered by the applicant's SMP. This includes (1) scaling, cracking, and spalling due to repeated freeze-thaw for Groups 1-3, 5, and 7-9 structures; (2) scaling, cracking, spalling and increase in porosity and permeability due to leaching of calcium hydroxide and aggressive chemical attack for Groups 1-5 and 7-9 structures; (3) expansion and cracking due to reaction with aggregates for Groups 1-5 and 7-9 structures; (4) cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel for Groups 1-5 and 7-9 structures; (5) cracks, distortion, and increase in component stress level due to settlement for Groups 1-3, 5, and 7-9 structures; (6) reduction of foundation strength due to erosion of porous concrete subfoundation for Groups 1-3 and 5-9 structures; (7) loss of material due to corrosion of structural steel components for Groups 1-5 and 7-8 structures; (8) loss of strength and modulus of concrete structures due to elevated temperatures for Groups 1-5 structures; and (9) crack initiation and growth due to SCC and loss of material due to crevice corrosion of stainless steel liner for Groups 7 and 8 structures. Further evaluation is necessary only for structure/aging effect combinations that are not covered by the applicant's SMP.

In LRA Table 3.5-1, the applicant addressed the above criterion defined in the GALL Report, regarding the need for further evaluation to manage the potential aging of concrete and steel structural components. In row entry 3.5.1.16 of LRA Table 3.5-1, the applicant stated that it will use the SMP to manage the aging effects identified in the preceding paragraph. However, the applicant stated in row entry 3.5.1.16 that (1) none of the above aging effects have been observed, to date, at FCS and (2) the aging mechanisms associated with these aging effects are not applicable.

By letter dated October 11, 2002, the staff issued RAI 3.5.1-6, requesting the applicant to clarify whether the aging of the concrete and steel structural components, encompassed by row entry 3.5.1.16 of LRA Table 3.5-1, will be managed by its SMP, as recommended by the GALL Report. By letter dated December 12, 2002, the applicant responded to RAI 3.5.1-6, stating the following:

> In the Discussion column of LRA AMR Item 3.5.1.16, there are nine items. Item number one indicates that the aging management of the concrete at FCS will be performed with a Structures Monitoring Program that is consistent with the GALL Report. Item numbers two through nine provide specific FCS information regarding the aging mechanisms described in Chapter IIA of the GALL Report. Although the plant specific information (items two through nine) indicates aging management is not required, FCS has indicated in item number one that a program will be credited for managing the aging of concrete for the period of extended operation.

Since the applicant is managing the aging effects for the concrete and steel structural items covered by row entry 3.5.1.16 of LRA Table 3.5-1, as recommended by the GALL Report, the staff finds that the applicant has adequately addressed this further evaluation criterion. The staff's evaluation of the applicant's SMP is found in Section 3.0.3.11 of this SER.

The staff reviewed the USAR Supplement for the SMP and concludes that it provides an adequate summary description of the programs and activities credited for managing the effects of aging for Class I structures for which the applicant claimed consistency with GALL to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of aging of Class I, as recommended in the GALL Report.

3.5.2.2.2.2 Aging Management of Inaccessible Areas

As stated in the SRP-LR, the GALL Report recommends further evaluation for aging of inaccessible concrete areas, such as below-grade foundation and exterior walls exposed to ground water, due to aggressive chemical attack, if an aggressive below-grade environment exists. An aggressive below-grade environment could result in either cracking or loss of material for concrete components subjected to such an environment. The GALL Report recommends that a plant-specific AMP be developed by the applicant, if an aggressive below-grade environment exists.

In LRA Table 3.5-1, the applicant addressed the above criterion defined in the GALL Report, regarding the potential aging of below-grade concrete exposed to an aggressive environment. In row entry 3.5.1.17 of LRA Table 3.5-1, the applicant stated the following:

> Below-grade exterior reinforced concrete at FCS is not exposed to an aggressive environment (pH less than 5.5), or to chloride or sulfate solutions beyond defined limits (greater than 500 ppm chloride, or greater than 1500 ppm sulfate). Periodic monitoring of below-grade water chemistry will be conducted during the period of extended operation to demonstrate that the below-grade environment is not aggressive.

In RAIs 3.5.1-19 and 3.5.1-8, the staff requested further information regarding (1) the ground water chemistry and (2) the monitoring of ground water chemistry to ensure that the below-grade environment is not aggressive. In its response to RAI 3.5.1-19, the applicant stated the following:

> The Missouri River water was tested periodically from 1973 to 1981. The results showed a pH average of 8.16, chlorides of 12.7 ppm, and sulfates of 200.6 ppm (USAR Section 2.7.1.4 in Table 2.7-3). River water test results from samples taken annually between 1990 and 1999 showed a pH average of 8.24.
>
> The groundwater was tested in August 1966 and the average results showed a pH of 7.3, chloride content of 34 ppm, and sulfate content of 162 ppm (USAR Section 2.7.2.3 in Table 2.7-4).
>
> To verify the river water and groundwater chemistry had not significantly changed over 20-30 years, a chemical analysis was performed in June 2000. Those test results indicated the groundwater pH was 7.48, chlorides were 8.0 ppm, and sulfates were 79.0 ppm; river water pH was 8.39, chlorides were 14.0 ppm, and sulfates were 229 ppm.

In its response to RAI 3.5.1-8, the applicant stated the following:

> Ground water and river water samples were taken in June 2000 and evaluation results were compared to samples taken during plant construction. No significant deviation in sample results was identified. A periodic task will be initiated as part of the Structures Monitoring Program (B.2.10) to take ground water samples on a five year frequency and compare the evaluation results to previous samples.

Since the ground water and river water chemistry parameters (pH, sulfates, and chlorides) indicate a non-aggressive environment, the staff concurs with the applicant's conclusion that further evaluation, as recommended by the GALL Report, is unnecessary. In addition, the applicant has committed to monitor and evaluate the ground water periodically during the period of extended operation. As such, RAIs 3.5.1-8 and 3.5.1-19 are considered closed.

On the basis of its review, the staff finds that the applicant has adequately evaluated the potential aging of below-grade concrete components exposed to ground water due to an aggressive environment. Since the below-grade environment is not aggressive, the further evaluation recommended by the GALL Report is not warranted.

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of inaccessible areas for Class I structures, as recommended in the GALL Report.

3.5.2.2.2.3 Conclusions

The staff has reviewed the applicant's evaluation of the issues for which GALL recommends further evaluation for Class I structures. On the basis of its review, the staff finds that the applicant has provided sufficient information to demonstrate that the issues for which GALL recommends further evaluation have been adequately addressed and that the subject aging effects will be adequately managed for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the USAR Supplement for the AMPs and concludes that they provide adequate summary descriptions of the programs and activities credited for managing the effects of aging for Class I structures for which the applicant claimed consistency with GALL to satisfy 10 CFR 54.21(d).

3.5.2.2.3 Component Supports

3.5.2.2.3.1 Aging of Supports Not Covered by Structures Monitoring Program

As stated in the SRP-LR, the GALL Report recommends further evaluation of certain component support/aging effect combinations if they are not covered by the SMP. This includes (1) reduction in concrete anchor capacity due to degradation of the surrounding concrete, for Groups B1-B5 supports; (2) loss of material due to environmental corrosion, for Groups B2-B5 supports; and (3) reduction/loss of isolation function due to degradation of vibration isolation elements, for Group B4 supports. Further evaluation is necessary only for the structure/aging effect combinations, listed above, that are not covered by the applicant's SMP.

In LRA Table 3.5-1, the applicant addressed the above criterion defined in the GALL Report, regarding the need for further evaluation to manage the potential aging of component supports. In row entry 3.5.1.25 of LRA Table 3.5-1, the applicant stated that it will use the SMP to manage the aging effects identified in the preceding paragraph.

Since the applicant is managing the aging effects for the component supports covered by row entry 3.5.1.25 of LRA Table 3.5-1, as recommended by the GALL Report, the staff finds that the applicant has adequately addressed this further evaluation criterion. The staff's evaluation of the applicant's SMP is found in Section 3.0.3.11 of this SER.

The staff reviewed the USAR Supplement for the SMP and concludes that it provides an adequate summary description of the programs and activities credited for managing the effects of aging for component supports for which the applicant claimed consistency with GALL to satisfy 10 CFR 54.21(d).

On the basis of its review, the staff finds that the applicant has adequately evaluated the management of aging of component supports, as recommended in the GALL Report.

3.5.2.2.3.2 Cumulative Fatigue Damage due to Cyclic Loading

As stated in the SRP-LR, the GALL Report identifies cumulative fatigue damage as a TLAA for support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3 component supports, if a CLB fatigue analysis exists. Since a CLB fatigue analysis does not exist at FCS, cumulative fatigue damage for component supports is not addressed by the applicant.

3.5.2.2.3.3 Conclusions

The staff has reviewed the applicant's evaluation of the issues for which GALL recommends further evaluation for component supports. On the basis of its review, the staff finds that the applicant has provided sufficient information to demonstrate that the issues for which the GALL recommends further evaluation have been adequately addressed and that the subject aging effects will be adequately managed for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the USAR Supplement for the SMP and concludes that it provides an adequate summary description of the programs and activities credited for managing the effects of aging for component supports for which the applicant claimed consistency with GALL to satisfy 10 CFR 54.21(d).

3.5.2.3 Aging Management Programs for Containment, Structures, and Component Supports

In SER Section 3.5.2.1, the staff evaluated the applicant's conformance with the aging management recommended by GALL for containment, other Class I structures, and component support component groupings. In SER Section 3.5.2.2, the staff reviewed the applicant's evaluation of the issues for which GALL recommends further evaluation. In this SER section, the staff presents its evaluation of the programs used by the applicant to manage the aging of the component groups within the containment, other Class I structures, and component supports.

The applicant credits 13 AMPs to manage the aging effects associated with the containment, other Class I structures, and component supports. Eleven of the AMPs are credited with managing aging for components in other system groups (common AMPs) while two AMPs are credited with managing aging only for structures and structural components. The staff's evaluation of the common AMPs credited with managing aging in structures and structural components is provided in Section 3.0.3 of this SER. The common AMPs are listed here:

- Bolting Integrity Program - SER Section 3.0.3.1
- Chemistry Program - SER Section 3.0.3.2
- Containment Inservice Inspection Program - SER Section 3.0.3.3
- Inservice Inspection Program - SER Section 3.0.3.5
- Boric Acid Corrosion Prevention Program - SER Section 3.0.3.6

- Cooling Water Corrosion Program - SER Section 3.0.3.7
- Fire Protection Program - SER Section 3.0.3.9
- Periodic Surveillance and Preventive Maintenance Program - SER Section 3.0.3.10
- Structures Monitoring Program - SER Section 3.0.3.11
- General Corrosion of External Surfaces Program - SER Section 3.0.3.12
- Selective Leaching Program - SER Section 3.0.3.14

The staff's evaluation of the two structure-specific AMPs are provided in the sections below.

3.5.2.3.1 Containment Leak Rate Program

The applicant described its containment leak rate program in Section B.1.4 of the LRA. The applicant credits this program with managing the potential aging of containment structures and components that are within the scope of license renewal and subject to an AMR. The staff reviewed the containment leak rate program to determine whether the applicant has demonstrated that the program will adequately manage the applicable effects of aging during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.1.1 Summary of Technical Information in the Application

The LRA states that the containment leak rate program is consistent with GALL program XI.S4, "10 CFR Part 50, Appendix J," and applicable sections of GALL program XI.S1, "ASME XI, Subsection IWE," related to Appendix J testing. In addressing the operating experience related to the program, the applicant stated that containment leaktight verification and visual examination of the steel components that are part of the leaktight barrier have been conducted at FCS since initial unit startup. Prior to the development of the ASME Section XI, Subsection IWE Inservice Inspection Program, examinations were performed in accordance with 10 CFR Part 50, Appendix J. No significant age-related degradation has been identified in the inspections performed.

3.5.2.3.1.2 Staff Evaluation

Section B.1.4 of the LRA describes the applicant's containment leak rate program. The LRA states that this AMP is consistent with GALL program XI.S4, "10 CFR Part 50, Appendix J," and applicable sections of GALL program XI.S1, "ASME XI, Subsection IWE," related to Appendix J testing, with no deviations. The staff also reviewed the USAR Supplement to determine whether it provides an adequate description of the program.

In addition to the review of Section B.1.4 of the LRA, the staff also reviewed the relevant portions of Section 3.5, "Aging Management of Containment, Structures, and Component Supports," and Section B.1.3, "Containment Inservice Inspection Program," of the LRA to correlate the results of the AMR and AMPs related to the containment.

The applicant's containment leak rate testing program is consistent with the provisions of GALL program XI.S4. Though the applicant does not explicitly describe the program as the one which assures the leaktight integrity of the FCS containment, GALL program XI.S4 describes the program as one that assures the essentially leaktight characteristics of the containment pressure boundary. Thus, the staff considers the basic purpose of the program is to ensure the leaktight integrity of the FCS containment. However, when a component shows a higher than acceptable leak rate, the cause could be related to the aging degradation of the component.

In response to a question related to the operating experience associated with Type A, Type B, and Type C tests (RAI B.1.4-1, issued by the staff on October 11, 2002), by letter dated December 12, 2002, the applicant indicated that none of the tests have exceeded twice the acceptance criteria for those components, i.e., containment structure, containment penetrations, and containment isolation valves. The staff considers the condition of the components adequate.

The applicant provided a summary description of the containment leak rate program in Section A.2.7 of the LRA. The description of the program cites the references that are being used in implementing the plant-specific program, and specifies that corrective actions are taken if leakage rates exceed the acceptance criteria. The staff considers the description of the program in the USAR Supplement acceptable.

3.5.2.3.1.3 Conclusion

On the basis of its review of the applicant’s program, the staff finds that those portions of the program for which the applicant claims consistency with GALL are consistent with GALL. The staff also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Therefore, on the basis of its review, the staff concludes that the applicant has demonstrated that the containment leak rate program will effectively manage aging in the structures and components for which this program is credited, so that the intended functions of the associated components and systems 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 Overhead Load Handling Systems Inspection Program

The overhead load handling systems inspection program is described in Section B.2.6 of Appendix B to the LRA. The program manages the effects of general corrosion on the crane and trolley structural components for those cranes that are within scope and subject to an AMR, and the effects of wear on the rails in the rail system. The staff reviewed the LRA to determine whether the applicant has demonstrated that the overhead load handling systems inspection program will adequately manage the aging effects for the components that credit this program throughout the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.2.1 Summary of Technical Information in the Application

The applicant states that the overhead load handling systems inspection program is consistent with GALL program XI.M23, “Inspection of Overhead Heavy Load and Light Load (Related to Fueling) Handling Systems,” with enhancements. The enhancements relate to expansion anchors and cover such items as establishing inspection guidance and acceptance criteria for general corrosion of the expansion anchor and cracking of the surrounding concrete.

Sections 2 and 3 of the LRA identify those components for which the overhead load handling systems inspection program is credited as an AMP. The AMR for the overhead load handling systems refers to Table 3.3-1 of the LRA, which indicates that the aging management of these items is consistent with GALL.

The applicant’s operating experience indicates that no aging effects which impact the intended functions of the structures or components were identified in the inspections performed.

3.5.2.3.2.2 Staff Evaluation

In LRA Section B.2.6, “Overhead Load Handling Systems Inspection Program,” the applicant described its AMP to manage overhead load handling systems. The LRA states that this AMP is consistent with GALL program XI.M23, “Inspection of Overhead Heavy Load and Light Load (Related to Fueling) Handling Systems,” with an enhancement related to the inspection of the anchor bolts for the load handling systems. The staff confirmed the applicant’s claim of consistency during the AMR inspection. Furthermore, the staff reviewed the enhancement and its justification to determine whether the AMP, with the enhancement, remains adequate to manage the aging effects for which it is credited, and reviewed the USAR Supplement to determine whether it provides an adequate description of the program.

The staff verified that the components in LRA Table 2.4.2.5-1 to which this program applies are commensurate with the intent of the GALL program X1.M23. The enhancements to several elements in the GALL program identified in the LRA were also reviewed. These enhancements would add more specific guidance for detection of aging effects, acceptance criteria, and corrective actions relating to concrete anchors for the equipment included in the program. Since the applicant is not taking any exception to GALL Report program X1.M23, but simply adding more specific guidance in the inspection procedures, the staff finds the enhancements reasonable and acceptable.

The staff reviewed the summary description of the overhead load handling inspection program in Appendix A of the LRA. The staff finds that the information in the USAR Supplement provides an adequate summary of the program activities as required by 10 CFR 54.21(d).

3.5.2.3.2.3 Conclusion

On the basis of its review and inspection of the applicant’s program, the staff finds that those portions of the program for which the applicant claims consistency with GALL are consistent with GALL. In addition, the staff has reviewed the enhancements to the GALL program and finds that the applicant’s program provides for adequate management of the aging effects for which the program is credited. The staff also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Therefore, on the basis of its review, the staff concludes that the applicant has demonstrated that the overhead load handling systems inspection program will effectively manage aging in the structures and components for which this program is credited, so that the intended functions of the associated components and systems will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.4 Aging Management Review of Plant-Specific Structures and Structural Components

In this section of the SER, the staff presents its review of the applicant’s AMRs for specific structures and structural components. To perform its evaluation, the staff reviewed the components listed in LRA Tables 2.4.2.1-1 through 2.4.2.7-1 to determine whether the applicant properly identified the applicable aging effects and AMPs needed to adequately manage these aging effects. This portion of the staff’s review involved identification of the aging effects for each component, ensuring that each component was evaluated in the appropriate LRA AMR Table in Section 3, and that management of the aging effect was captured in the appropriate AMP. The results of the staff’s review are provided below.

3.5.2.4.1 <u>Containment</u>

3.5.2.4.1.1 Summary of Technical Information in the Application

The AMR results for the containment are presented in Tables 3.5-1, 3.5-2, and 3.5-3 of the LRA. The applicant used the GALL Report format to present its AMR of containment components in LRA Table 3.5-1. In LRA Tables 3.5-2 and 3.5-3, the applicant identified the component group designation along with its (1) material, (2) environment, (3) aging effect(s), and (4) AMP(s).

As described in Section 2.4.1 of the LRA, the containment structure is a partially prestressed, reinforced concrete, Class I structure composed of a cylindrical wall, domed roof, and a bottom mat. The mat is common to both the containment structure and the auxiliary building and is supported on steel piles driven to bedrock. The containment has a 1/4 inch internal carbon steel liner. The materials of construction for the containment structure, as shown in Table 2.4.1-1 of the LRA, are steel, concrete, and miscellaneous materials such as calcium silicate and elastomers. These materials are exposed to containment air, indoor (ambient) air, outdoor air, borated water, treated water, and a buried environment.

Aging Effects

The LRA identifies the following aging effects for the containment structure:

- cracking, loss of material, and change in material properties for concrete components
- cracking, loss of material, and change in material properties for containment grout
- cracking for masonry block walls
- cumulative fatigue, cracking, and loss of material for steel containment penetrations
- loss of material for carbon steel structural components
- loss of prestress for containment tendons
- loss of seal for elastomers

Aging Management Programs

The LRA credits the following AMPs with managing the identified aging effects for the containment structure:

- Containment Inservice Inspection Program
- Chemistry Program
- Fire Protection Program
- Containment Leak Rate Program
- Structures Monitoring Program

A description of these AMPs is provided in Appendix B of the LRA.

3.5.2.4.1.2 Staff Evaluation

In addition to Section 3.5 of the LRA, the staff reviewed the pertinent information provided in Section 2.4, “Scoping and Screening Results: Structures,” and the applicable AMP descriptions provided in Appendix B of the LRA, to determine whether the aging effects for the containment components have been properly identified and will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

This section of the SER provides the staff's evaluation of the applicant's AMR for the aging effects and the appropriateness of the programs credited for the aging management of the containment structural components at FCS. The staff's evaluation includes a review of the aging effects considered and the basis for the applicant's elimination of certain aging effects. In addition, the staff has evaluated the appropriateness of the AMPs that are credited for managing the identified aging effects for the containment components.

Aging Effects

Concrete: For containment concrete components, the applicant's AMR is consistent with the recommendations in the GALL Report. As such, the applicant has committed to manage cracking, change in material properties, and loss of material for containment concrete components that are accessible. However, for several of the table entries in LRA Table 3.5-1, the applicant stated that the aging effect/mechanism combinations identified in the GALL Report are not applicable to FCS. In RAIs 3.5-1, 3.5.1-7, 3.5.1-12, 3.5.1-15, and 3.5.1-16, the staff requested that the applicant clarify its intentions to manage the aging effect/mechanism combinations as recommended by the GALL Report. In its response to these RAIs, the applicant stated the following:

> For concrete at FCS, even though OPPD has concluded that the AERMs identified for concrete in the GALL Report are not applicable due to the plant's operating experience, OPPD has committed to be consistent with the GALL Report and monitor for the possibility of the AERMs with the programs identified in the GALL Report.

The staff takes exception to the applicant's claim that the aging effects identified in the GALL Report are not applicable for concrete at FCS; however, since the applicant has committed to monitor for these aging effects using the appropriate AMPs, the staff considers the applicant's response to be adequate. As such, the staff considers RAIs 3.5-1, 3.5.1-7, 3.5.1-12, 3.5.1-15, and 3.5.1-16 closed.

In RAI 3.5.1-2, the staff requested further information regarding the LRA Table 2.4.1-1 entry entitled, "Containment Grout in Ambient Air." Specifically, the staff asked the applicant for further information regarding the location of the grout within the containment and the aging management of the grout. In response to RAI 3.5.1-2, the applicant stated the following:

> "Containment Grout in Ambient Air" includes grout under baseplates that are not typically exposed to fluids, flowing or otherwise. The table referenced in the RAI provides links to LRA AMR Items that are consistent with the recommendations in the GALL Report and credit the recommended AMPs.

Since the applicant has committed to manage the aging of grout within the containment as recommended by the GALL Report, the staff considers the applicant's response to RAI 3.5.1-2 adequate.

In RAI 3.5.3-1, the staff requested further information regarding the aging management of the ungrouted masonry walls in the containment. Specifically, the staff requested that the applicant provide further information concerning the (1) location of these walls, (2) environment to which they are subjected, (3) time-interval for examining the walls, and (4) operating experience related to these walls. In response to RAI 3.5.3-1, the applicant provided a map showing the location of the ungrouted masonry walls. There are four ungrouted masonry walls at the 989 ft elevation level of the containment. The temperature, humidity, and radiation level that these walls are exposed to are 120 °F, 20 to 100 percent, and 10 R/hr averaged over a 40 year life, respectively. The applicant also stated that the masonry walls in the containment are inspected during the performance of the containment inspection surveillance test, which is performed every other refueling outage. In addition, the applicant stated that containment inspections performed in 1996, 1999, and 2002, did not identify any degradation of the masonry walls. The staff considers that the applicant's response to RAI 3.5.3-1 adequately demonstrates that there is no significant degradation of the ungrouted masonry walls in the containment, and that the aging of these walls will be adequately monitored during the period of extended operation.

For below-grade containment concrete components, the GALL Report recommends aging management only for an aggressive below-grade soil/ground water environment. Since ASME Section XI, Subsection IWL exempts from examination those portions of the concrete containment that are inaccessible, the GALL Report recommends that a plant-specific AMP be developed for concrete that may be exposed to an aggressive below-grade soil/ground water environment. As stated previously in SER Sections 3.5.2.2.1.1 and 3.5.2.2.2.2, the applicant adequately demonstrated that the ground water chemistry parameters (pH, sulfates, and chlorides) indicate a non-aggressive environment. Therefore, a plant-specific AMP for below-grade concrete components is not warranted. However, 10 CFR 50.55a(b)(2)(ix) requires that the licensee evaluate the acceptability of inaccessible areas when conditions exist in accessible areas that could indicate the presence of, or result in, degradation to such inaccessible areas.

In RAI 3.5.1-1, the staff requested further information concerning (1) the condition of the containment tendon gallery, which is below-grade and accessible for inspection, and (2) the possibility of using the condition of the below-grade containment tendon gallery as an indicator for the aging of other inaccessible containment concrete components. In response to RAI 3.5.1-1, the applicant stated the following:

> The exterior of the below-grade concrete wall of the tendon gallery is, by definition, inaccessible for inspection. If the reviewer is implying that inspections of the inside of the below-grade tendon gallery wall will provide evidence that the environment on the outside of the wall is not adversely affecting the concrete, then the results of these inspections performed to date indicate that no external degradation is occurring. Although the tendon gallery is not part of the Containment boundary, it is included as part of the Containment inspections. In October 1999, there was no evidence of active concrete degradation (i.e., no residue indicating spalling concrete). Additionally, there were no signs of active seepage and all surfaces were dry. Fine cracks that had been noted in earlier inspections and monitored in subsequent inspections showed no signs of movement from those previous inspections.

Since the applicant's previous inspections of the containment tendon gallery indicate that there is not any significant aging, and since the ground water chemistry parameters are within the bounds recommended by the GALL Report, the staff concurs with the applicant's assertion that external degradation of below-grade concrete components is not likely to be significant. In the event that below-grade structural components are exposed by excavation, the applicant stated, in LRA Section B.2.10, "Structures Monitoring Program," that guidance will be added to inspect these components.

The staff finds that the applicant's approach for evaluating the applicable aging effects for concrete components in containment to be reasonable and acceptable. The staff concludes that the applicant has properly identified the aging effects for concrete components in containment.

Steel: Consistent with the GALL Report recommendations, the applicant identified loss of material for containment carbon steel structural components, and cumulative fatigue, cracking, and loss of material as applicable aging effects for steel containment penetrations. Loss of prestress for containment tendons is also identified as an applicable aging effect by the applicant.

Loss of material due to corrosion of the embedded containment liner and cracking of containment penetrations due to cyclic loading are identified by the GALL Report as aging effects requiring further evaluation and are covered in detail in Sections 3.5.2.2.1.4 and 3.5.2.2.1.7, respectively, of this SER. Loss of prestress for containment tendons is evaluated as a TLAA and reviewed by the staff in Section 4.5 of this SER.

For stainless steel components that are exposed to only ambient air, the applicant did not identify any applicable aging effects. This latter category includes stainless steel threaded fasteners. In RAI 3.5.1-11, the staff requested that the applicant justify its conclusion regarding the aging management of stainless steel threaded fasteners. Specifically, the staff pointed out that these stainless steel fasteners may be subject to aging effects if exposed to a wetted or moist environment. In its response the applicant stated the following:

> These stainless steel threaded fasteners are for the fuel transfer tube blind flange (containment side). The blind flange is removed prior to filling the refueling canal; therefore, the fasteners are not subject to an environment that would support aging effects.

Since the stainless steel threaded fasteners are not exposed to a wetted or moist environment, the staff supports the applicant's conclusion that there are no applicable aging effects for these fasteners. As such, the staff considers RAI 3.5.1-11 to be resolved.

The staff finds that the applicant's approach for evaluating the applicable aging effects for steel components in containment to be reasonable and acceptable. The staff concludes that the applicant has properly identified the aging effects for steel components in containment.

Elastomers (moisture barriers, seals): Consistent with the GALL Report recommendations, the applicant identified loss of seal as an applicable aging effect for the equipment hatch gasket, which is made of neoprene.

The staff finds that the applicant's approach for evaluating the applicable aging effect for elastomers in containment to be reasonable and acceptable. The staff concludes that the applicant has properly identified the aging effect for elastomers in containment.

On the basis of its review, the staff finds the applicant has identified the appropriate aging effects for the materials and environments associated with the containment.

Aging Management Programs

Tables 3.5-1 through 3.5-3 of the LRA credit the following AMPs with managing the identified aging effects for the components in the containment:

- Containment Inservice Inspection Program
- Chemistry Program
- Fire Protection Program
- Containment Leak Rate Program
- Structures Monitoring Program

With the exception of the containment leak rate program, each of the above AMPs are credited with managing the aging of several components in several different structures and systems and are, therefore, considered common AMPs. The staff's review of the common AMPs is in Section 3.0.3 of this SER. The staff's evaluation of the containment leak rate program is presented in Section 3.5.2.3.1 of this SER.

After evaluating the applicant's AMR for each of the components in the containment, the staff evaluated the AMPs listed above to determine if they are appropriate for managing the identified aging effects. For those components identified in Table 3.5-1 of the LRA, the staff verified that the applicant credited the AMPs recommended by the GALL Report. For the components identified in LRA Tables 3.5-2 and 3.5-3, the staff verified that the applicant credited an AMP that is appropriate for the identified aging effect(s).

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with containment. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

3.5.2.4.1.3 Conclusions

The staff has reviewed the information in Sections 2.4 and 3.5 of the LRA, the applicant's responses to the staff's RAIs, and the applicable AMP descriptions in Appendix B of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the components in the containment will be adequately managed so that these components will perform their intended functions in accordance with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR Supplement program descriptions and concludes that the USAR Supplements provide adequate program descriptions of the AMPs credited for managing aging in the containment to satisfy 10 CFR 54.21(d).

3.5.2.4.2 <u>Other Structures</u>

3.5.2.4.2.1 Summary of Technical Information in the Application

The AMR results for structures outside the containment are presented in Tables 3.3-1, 3.3-2, 3.5-1, 3.5-2, and 3.5-3 of the LRA. The applicant used the GALL Report format to present its AMR of structural components in LRA Table 3.5-1. In LRA Tables 3.5-2 and 3.5-3, the applicant identified the component group designation along with its (1) material, (2) environment, (3) aging effect(s), and (4) AMP(s). The structural components listed in Tables 3.5-1 through 3.5-3 of the LRA are in the following structures:

- auxiliary building
- turbine building
- service building
- intake structure
- building piles

A brief description of each of the above structures is provided in Section 2.4.2, "Other Structures," of the LRA. For each structure in LRA Section 2.4.2, the applicant also provides a list of the in-scope components in an accompanying table. In addition to the in-scope structural components identified in LRA Section 2.4.2, in response to Open Item 2.3.3.15-1, the applicant also brought the circulating water discharge tunnel into scope. The applicant stated that the tunnel would be included as part of the intake structure. The staff has determined that the in-scope structural components of the circulating water tunnel are already identified in the intake structure. Therefore, the aging management review results for the intake structure are applicable to the circulating water discharge tunnel.

The materials of construction identified in the LRA for each of the above structures are (1) steel, (2) concrete, (3) elastomers, (4) fire protection materials, (5) polyvinyl chloride (PVC), (6) earth fill, (7) cast iron, (8) bronze, and (9) brass. These materials are exposed to outdoor, buried, indoor, borated water, and raw water environments.

Aging Effects

Tables 3.5-1 through 3.5-3 of the LRA identify the following applicable aging effects for components in structures outside the containment:

- loss of material
- change in material properties
- cracking
- separation
- loss of mechanical function
- reduction in concrete anchor capacity

Aging Management Programs

Tables 3.5-1 through 3.5-3 of the LRA credit the following AMPs with managing the identified aging effects for the components in structures outside the containment:

- Chemistry Program
- Inservice Inspection Program
- Fire Protection Program
- Periodic Surveillance and Preventive Maintenance Program
- Structures Monitoring Program
- General Corrosion of External Surfaces Program
- Selective Leaching Program
- Cooling Water Corrosion Program

A description of these AMPs is provided in Appendix B of the LRA.

3.5.2.4.2.2 Staff Evaluation

In addition to Section 3.5 of the LRA, the staff reviewed the pertinent information provided in Section 2.4, "Scoping and Screening Results: Structures," and the applicable AMP descriptions provided in Appendix B of the LRA to determine whether the aging effects for the components in structures outside the containment have been properly identified and will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

This section of the SER provides the staff's evaluation of the applicant's AMR for the aging effects and the appropriateness of the programs credited for the aging management of structural components at FCS. The staff's evaluation includes a review of the aging effects considered and the basis for the applicant's elimination of certain aging effects. In addition, the staff has evaluated the appropriateness of the AMPs that are credited for managing the identified aging effects for the components in structures outside of containment.

Aging Effects

Concrete: For concrete components in structures outside the containment, the applicant's AMR is consistent with the recommendations in the GALL Report. As such, the applicant has committed to manage cracking, change in material properties, and loss of material for concrete structural components that are accessible. As stated previously in Section 3.5.2.4.1.2 of this SER, the applicant stated in LRA Table 3.5-1 that, although they are consistent with the GALL Report, they do not consider the aging effects/mechanisms identified by the GALL for concrete to be applicable to concrete structures at FCS. To clarify the applicant's intent with regard to the aging management of concrete structural components, the staff requested in several RAIs (3.5-1, 3.5.1-7, 3.5.1-12, 3.5.1-15, and 3.5.1-16) that the applicant provide further information regarding this apparent discrepancy. In response, the applicant stated that although they do not consider these aging effects to be applicable, they will manage the aging of concrete structures at FCS as recommended by the GALL Report. Since the applicant clarified its intentions to manage the aging of concrete structures at FCS, the staff considers the response to the staff's RAIs adequate.

For below-grade concrete structural components, the GALL Report recommends aging management only for an aggressive below-grade soil/ground water environment. As stated previously in SER Section 3.5.2.2.2.2, the applicant adequately demonstrated that the ground water chemistry parameters (pH, sulfates, and chlorides) indicate a non-aggressive environment. Therefore, aging management of below-grade concrete components is not warranted. To insure that the below-grade environment remains non-aggressive, the applicant has committed to periodically monitor the ground water chemistry through its structural monitoring program.

The staff finds that the applicant's approach for evaluating the applicable aging effects for concrete components in structures outside the containment to be reasonable and acceptable. The staff concludes that the applicant has properly identified the aging effects for concrete components in these structures.

Steel: Consistent with the recommendations of the GALL Report, the applicant identified loss of material as an applicable aging effect for carbon steel components in structures outside the containment. This includes all Class I structures identified in the GALL Report. For carbon steel expansion/grouted anchors, the applicant identified loss of material and reduction in concrete anchor capacity as applicable aging effects. These steel expansion/grouted anchors are found in the auxiliary building, turbine and service buildings, and intake structure.

For below-grade pipe piles, the applicant did not identify any applicable aging effects. This position is consistent with the agreement in NUREG 1557, "Summary of Technical Information and Agreements from Nuclear Management and Resource Council Industry Reports Addressing License Renewal," which states the following:

> Steel piles driven in undisturbed soils have been unaffected by corrosion and those driven in disturbed soil experience minor to moderate corrosion to a small area of metal.

For stainless steel components, the applicant identified loss of material as an applicable aging effect for (1) the intake structure pump gland bolting, which is exposed to raw water and (2) the fuel transfer penetration fasteners, which are exposed to borated treated water. The applicant also identifies cracking as an applicable aging effect for the stainless steel spent fuel pool liner, the refueling canal liner, and the pipe penetrations for the safety injection and refueling water tank. For structural stainless steel in ambient air the applicant did not identify any applicable aging effects.

The staff finds that the applicant's approach for evaluating the applicable aging effects for steel components in structures outside the containment to be reasonable and acceptable. The staff concludes that the applicant has properly identified the aging effects for steel components in these structures.

Elastomers: For the auxiliary building and intake structure flood panel seals, the applicant identified change in material properties and cracking as applicable aging effects. Since neither of these components are identified in the GALL Report, the applicant lists these items in LRA Table 3.5-2. The staff concurs with the applicant's identification of these two aging effects for elastomer material components.

The staff finds that the applicant's approach for evaluating the applicable aging effects for elastomers in structures outside the containment to be reasonable and acceptable. The staff concludes that the applicant has properly identified the aging effects for elastomers in these structures.

Fire Protection Materials (glass, mineral fiber, pyrocrete, masonry): For the glass used in the metal fire penetration barriers, the applicant did not identify any applicable aging effects. For mineral fiber and pyrocrete fire barriers, the applicant identified separation, cracking, and loss of material as applicable aging effects. For masonry block walls used as fire barriers, the applicant identified cracking as an applicable aging effect.

The staff concurs with the applicant's identification of the applicable aging effects for the pyrocrete fire barriers and masonry block walls. For the glass used in metal fire penetration barriers, the staff concurs with the applicant's conclusion that there are no applicable aging effects.

Miscellaneous Metals (cast iron, bronze, brass): For the cast iron stuffing box floor penetration in the intake structure, the applicant identified loss of material as an applicable aging effect. The applicant did not identify any aging effects for the auxiliary building removable slab lifting devices, which are made from bronze. Cast iron, bronze, and brass are used for gland and gland bolting in the intake structure. Since the gland bolting is in a raw water environment, the applicant identified loss of material as an applicable aging effect.

The staff concurs with the applicant's identification of loss of material as an aging effect for the cast iron stuffing box floor penetration in the intake structure and for the gland bolting in a raw water environment. Since the bronze removable slab lifting devices are not exposed to a harsh environment, the staff concurs with the applicant's conclusion that there are no applicable aging effects.

Miscellaneous Materials (PVC, earth fill): For the auxiliary building pressure relief panels made from PVC, the applicant identified change in material properties and cracking as applicable aging effects. For the earth fill, made from sand and gravel, surrounding the diesel fire pump fuel storage tank, the applicant did not identify any applicable aging effects.

The staff concurs with the aging effects identified by the applicant for the PVC pressure relief panels. Since the sand and gravel earth fill is not exposed to wave action or running water, the staff concurs with the applicant's conclusion that there are no applicable aging effects.

On the basis of its review, the staff finds the applicant has identified the appropriate aging effects for the materials and environments associated with the auxiliary, turbine and service buildings, the intake structure, or the building piles.

Aging Management Programs

Tables 3.5-1 through 3.5-3 of the LRA credit the following AMPs with managing the identified aging effects for the components in structures outside the containment:

- Chemistry Program
- Inservice Inspection Program
- Fire Protection Program
- Periodic Surveillance and Preventive Maintenance Program
- Structures Monitoring Program
- General Corrosion of External Surfaces Program
- Selective Leaching Program
- Cooling Water Corrosion Program

Each of the above AMPs are credited with managing the aging of several components in several different structures and systems and are, therefore, considered common AMPs. The staff's review of the common AMPs is in Section 3.0.3 of this SER.

After evaluating the applicant's AMR for each of the components in structures outside the containment, the staff evaluated the AMPs listed above to determine if they are appropriate for managing the identified aging effects. For those components identified in Table 3.5-1 of the LRA, the staff verified that the applicant credited the AMP recommended by the GALL Report. For the components identified in LRA Tables 3.5-2 and 3.5-3, the staff verified that the applicant credited an AMP that is appropriate for the identified aging effect(s).

The staff also reviewed the applicable USAR Supplement program descriptions and concludes that the USAR Supplements provide adequate program descriptions of the AMPs credited for managing aging in the auxiliary, turbine and service buildings, the intake structure, or the building piles to satisfy 10 CFR 54.21(d).

3.5.2.4.2.3 Conclusions

The staff has reviewed the information in Sections 2.4 and 3.5 of the LRA, the applicant's responses to the staff's RAIs, and the applicable AMP descriptions in Appendix B of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the components in structures outside the containment will be adequately managed so that these components will perform their intended functions in accordance with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR Supplement program descriptions and concludes that the USAR Supplements provide adequate program descriptions of the AMPs credited for managing aging in the auxiliary, turbine and service buildings, the intake structure, and the building piles to satisfy 10 CFR 54.21(d).

3.5.2.4.3 <u>Fuel Handling Equipment and Heavy Load Cranes</u>

3.5.2.4.3.1 Summary of Technical Information in the Application

The AMR results for the fuel handling equipment and heavy load cranes are presented in Tables 3.3-1, 3.3-2, and 3.3-3 of the LRA. The applicant used the GALL Report format to present its AMR of the components in LRA Table 3.3-1. In LRA Tables 3.3-2 and 3.3-3, the applicant identified the component group designation along with its (1) material, (2) environment, (3) aging effect(s), and (4) AMP(s).

The components comprising the fuel handling equipment and heavy load cranes commodity group include all of the components used in the storage and handling of new/spent fuel and in the hoisting of loads. As stated in Section 2.4.2.5 of the LRA, the fuel handling equipment portion of this commodity consists of the refueling machine, tilting machines in the containment and auxiliary building, fuel transfer conveyor, fuel transfer carrier box, fuel transfer tube, new and spent fuel handling tools, new and spent fuel storage racks, and spent fuel bridge. The heavy load cranes portion of this commodity consists of eight cranes of varying types (i.e., overhead crane, hoist with monorail, and jib crane).

The materials of construction for the fuel handling equipment and heavy load cranes commodity group are (1) carbon steel, (2) stainless steel, (3) aluminum, and (4) boral. These materials are exposed to ambient air and borated water.

Aging Effects

Tables 3.3-1 through 3.3-3 of the LRA identify the following applicable aging effects for the fuel handling equipment and heavy load cranes commodity group:

- cracking
- loss of material
- reduction in neutron absorbing capacity

Aging Management Programs

Tables 3.3-1 through 3.3-3 of the LRA credit the following AMPs with managing the identified aging effects for the fuel handling equipment and heavy load cranes commodity group:

- Overhead Load Handling Systems Inspection Program
- Chemistry Program
- Structures Monitoring Program
- Periodic Surveillance and Preventive Maintenance Program

A description of these AMPs is provided in Appendix B of the LRA.

3.5.2.4.3.2 Staff Evaluation

In addition to Section 3.3 of the LRA, the staff reviewed the pertinent information provided in Section 2.4, "Scoping and Screening Results: Structures," and the applicable AMP descriptions provided in Appendix B of the LRA to determine whether the aging effects for the fuel handling equipment and heavy load cranes commodity group have been properly identified and will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).
This section of the SER provides the staff's evaluation of the applicant's AMR for the aging effects and the appropriateness of the programs credited for the aging management of the fuel handling equipment and heavy load cranes commodity group at FCS. The staff's evaluation includes a review of the aging effects considered and the basis for the applicant's elimination of certain aging effects. In addition, the staff has evaluated the appropriateness of the AMPs that

are credited for managing the identified aging effects for the fuel handling equipment and heavy load cranes commodity group.

Aging Effects

Steel: Consistent with the recommendations of the GALL Report, the applicant identified loss of material and aging of component materials as applicable aging effects for each of the carbon steel components in the fuel handling equipment and heavy load cranes commodity group. For stainless steel components in this commodity group that are exposed to ambient air and borated water, the applicant identified cracking and loss of material as applicable aging effects. For stainless steel components that are exposed to only ambient air, the applicant did not identify any applicable aging effects.

The staff finds that the applicant's approach for evaluating the applicable aging effects for steel components for fuel handling equipment and heavy load cranes to be reasonable and acceptable. The staff concludes that the applicant has properly identified the aging effects for steel components in the fuel handling equipment and heavy load cranes.

Miscellaneous Metals (aluminum, boral): For the aluminum new and spent fuel handling tools that are exposed to both ambient air and borated water, the applicant identified cracking and loss of material as applicable aging effects. For the aluminum new fuel storage racks that are exposed only to ambient air, the applicant did not identify any applicable aging effects. Similarly, for the boral new fuel storage racks that are exposed only to ambient air, the applicant did not identify any applicable aging effects. However, for the boral spent fuel storage racks that are exposed to both ambient air and borated water, the applicant identified reduction in neutron absorbing capacity as an applicable aging effect, which is consistent with the GALL Report.

The staff concurs with the applicant's identification of cracking and loss of material as applicable aging effects for aluminum and boral components exposed to both borated water and ambient air. In addition, the staff concurs with the applicant's conclusion that there are no applicable aging effects for boral and aluminum components that are exposed only to ambient air.

On the basis of its review, the staff finds the applicant has identified the appropriate aging effects for the materials and environments associated with the fuel-handling equipment and heavy load cranes.

Aging Management Programs

Tables 3.3-1 through 3.3-3 of the LRA credit the following AMPs with managing the identified aging effects for the fuel handling equipment and heavy load cranes commodity group:

- Overhead Load Handling Systems Inspection Program
- Chemistry Program
- Structures Monitoring Program
- Periodic Surveillance and Preventive Maintenance Program

With the exception of the overhead load handling system inspection program, each of the above AMPs is credited with managing the aging of several components in several different structures and systems and are, therefore, considered common AMPs. The staff's review of the common AMPs is in Section 3.0.3 of this SER. The staff review of the overhead load handling system inspection program is in Section 3.5.2.3.2 of this SER.

After evaluating the applicant's AMR for each of the components in the fuel handling equipment and heavy load cranes commodity group, the staff evaluated the AMPs listed above to determine if they are appropriate for managing the identified aging effects. For those components identified in Table 3.3-1 of the LRA, the staff verified that the applicant credited the AMP recommended by the GALL Report. For the components identified in LRA Tables 3.3-2 and 3.3-3, the staff verified that the applicant credited an AMP that is appropriate for the identified aging effect(s).

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with the fuel-handling equipment and heavy load cranes. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d)

3.5.2.4.3.3 Conclusion

The staff has reviewed the information in Sections 2.4 and 3.3 of the LRA, as well as the applicable AMP descriptions in Appendix B of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the components in the fuel handling equipment and heavy load cranes commodity group will be adequately managed so that these components will perform their intended functions in accordance with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR Supplement program descriptions and concludes that the USAR Supplements provide adequate program descriptions of the AMPs credited for managing aging in the fuel-handling equipment and heavy load cranes to satisfy 10 CFR 54.21(d).

3.5.2.4.4 Component Supports

3.5.2.4.4.1 Summary of Technical Information in the Application

The AMR results for the component supports are presented in Tables 3.5-1, 3.5-2, and 3.5-3 of the LRA. The applicant used the GALL Report format to present its AMR of the components in LRA Table 3.5-1. In LRA Tables 3.5-2 and 3.5-3, the applicant identified the component group designation along with its (1) material, (2) environment, (3) aging effect(s), and (4) AMP(s).

As stated in Section 2.4.2.6 of the LRA, the components comprising the component supports commodity group consist of the structural connection between a system, or component within a system, and a plant building structural concrete or steel member. Supports for both the distributive portion of the systems (pipe, conduit, tubing, raceway) and the system's equipment are included.

The materials of construction for the component supports commodity group are (1) carbon steel, (2) stainless steel, (3) lubrite, and (4) trisodium phosphate. These materials are exposed to ambient air and borated water.

Aging Effects

Tables 3.5-1 through 3.5-3 of the LRA identify the following applicable aging effects for the component supports commodity group:

- loss of material
- cracking
- loss of mechanical function

Aging Management Programs

Tables 3.5-1 through 3.5-3 of the LRA credit the following AMPs with managing the identified aging effects for the component supports commodity group:

- Boric Acid Corrosion Prevention Program
- Bolting Integrity Program
- Chemistry Program
- Structures Monitoring Program
- Inservice Inspection Program

A description of these AMPs is provided in Appendix B of the LRA.

3.5.2.4.4.2 Staff Evaluation

In addition to Section 3.5 of the LRA, the staff reviewed the pertinent information provided in Section 2.4, “Scoping and Screening Results: Structures,” and the applicable AMP descriptions provided in Appendix B of the LRA to determine whether the aging effects for the component supports commodity group have been properly identified and will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

This section of the SER provides the staff’s evaluation of the applicant’s AMR for the aging effects and the appropriateness of the programs credited for the aging management of the component supports commodity group at FCS. The staff’s evaluation includes a review of the aging effects considered and the basis for the applicant’s elimination of certain aging effects. In addition, the staff has evaluated the appropriateness of the AMPs that are credited for managing the identified aging effects for the component supports commodity group.

Aging Effects

Steel: Consistent with the recommendations of the GALL Report, the applicant identified loss of material as an applicable aging effect for the carbon steel component supports. In addition, for the high-strength carbon steel threaded fasteners, the applicant identified cracking due to SCC, as well as loss of material, as applicable aging effects. For stainless steel component supports in borated water, the applicant identifies loss of material and cracking as applicable aging effects. However, for stainless structural steel in ambient air, the applicant did not identify any applicable aging effects. Finally, for stainless steel threaded fasteners, the applicant identified cracking as an applicable aging effect.

The staff finds that the applicant’s approach for evaluating the applicable aging effects for steel component supports to be reasonable and acceptable. The staff concludes that the applicant has properly identified the aging effects for steel component supports.

Miscellaneous Material (lubrite, trisodium phosphate): For lubrite plates used for component supports, the applicant identified loss of mechanical function as an applicable aging effect. However, this material is not directly specified in LRA Table entry 3.5.1.28. In RAI 3.5.1-18, the staff requested that the applicant clarify its aging management for lubrite plates. In response, the applicant stated that this LRA table entry should have referred also to non-steel components (including lubrite plates) and that loss of mechanical function will be managed for this component. The applicant's response adequately clarifies the aging management for lubrite plates and is therefore, acceptable to the staff.

For trisodium phosphate baskets in ambient air, the applicant did not identify any applicable aging effects. Since these trisodium phosphate baskets are not exposed to a harsh environment, the staff concurs with the applicant's conclusion that there are no applicable aging effects.

The staff finds that the applicant's approach for evaluating the applicable aging effects for miscellaneous material used for component supports to be reasonable and acceptable. The staff concludes that the applicant has properly identified the aging effects for miscellaneous material used for component supports.

On the basis of its review, the staff finds the applicant has identified the appropriate aging effects for the materials and environments associated with component supports.

Aging Management Programs

Tables 3.5-1 through 3.5-3 of the LRA credit the following AMPs with managing the identified aging effects for the component supports commodity group:

- Boric Acid Corrosion Prevention Program
- Bolting Integrity Program
- Chemistry Program
- Structures Monitoring Program
- Inservice Inspection Program

Each of the above AMPs are credited with managing the aging of several components in several different structures and systems and are, therefore, considered common AMPs. The staff's review of the common AMPs is in Section 3.0.3 of this SER.

After evaluating the applicant's AMR for each of the components in the component supports commodity group, the staff evaluated the AMPs listed above to determine if they are appropriate for managing the identified aging effects. For those components identified in Table 3.5-1 of the LRA, the staff verified that the applicant credited the AMP recommended by the GALL Report. For the components identified in LRA Tables 3.5-2 and 3.5-3, the staff verified that the applicant credited an AMP that is appropriate for the identified aging effect(s).

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with component supports. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d).

3.5.2.4.4.3 Conclusions

The staff has reviewed the information in Sections 2.4 and 3.5 of the LRA, the applicant's response to the staff's RAI, and the applicable AMP descriptions in Appendix B of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the components in the component supports commodity group will be adequately managed so that these components will perform their intended functions in accordance with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR Supplement program descriptions and concludes that the USAR Supplements provide adequate program descriptions of the AMPs credited for managing aging in the component supports to satisfy 10 CFR 54.21(d).

3.5.2.4.5 <u>Duct Banks</u>

3.5.2.4.5.1 Summary of Technical Information in the Application

The AMR results for the duct banks are presented in Tables 3.5-1, 3.5-2, and 3.5-3 of the LRA. The applicant used the GALL Report format to present its AMR of the components in LRA Table 3.5-1. In LRA Tables 3.5-2 and 3.5-3, the applicant identified the component group designation along with its (1) material, (2) environment, (3) aging effect(s), and (4) AMP(s).

As stated in Section 2.4.2.7 of the LRA, duct banks are comprised of conduits encased in concrete and are located below grade. Duct banks are used to route electrical power cables between buildings. Electrical manholes are reinforced concrete box-type structures which allow for inspection and routing of the cables.

The materials of construction for the duct banks are (1) concrete, (2) carbon steel, (3) gray cast iron, and (4) polyurethane foam. These materials are exposed to ambient air, outdoor air, and a buried environment.

Aging Effects

Tables 3.5-1 through 3.5-3 of the LRA identify the following applicable aging effects for the duct banks:

- loss of material
- cracking
- change in material properties
- separation

Aging Management Programs

Table 3.5-1 through 3.5-3 of the LRA credit the following AMPs with managing the identified aging effects for the duct banks:

- Structures Monitoring Program
- Periodic Surveillance and Preventive Maintenance Program

A description of these AMPs is provided in Appendix B of the LRA.

3.5.2.4.5.2 Staff Evaluation

In addition to Section 3.5 of the LRA, the staff reviewed the pertinent information provided in Section 2.4, “Scoping and Screening Results: Structures,” and the applicable AMP descriptions provided in Appendix B of the LRA to determine whether the aging effects for the duct banks have been properly identified and will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

This section of the SER provides the staff’s evaluation of the applicant’s AMR for the aging effects and the appropriateness of the programs credited for the aging management of the duct banks at FCS. The staff’s evaluation includes a review of the aging effects considered and the basis for the applicant’s elimination of certain aging effects. In addition, the staff has evaluated the appropriateness of the AMPs that are credited for managing the identified aging effects for the duct banks.

Aging Effects

Concrete: For the accessible concrete portion of the duct banks, the applicant’s AMR is consistent with the recommendations in the GALL Report. As such, the applicant has committed to manage cracking, change in material properties, and loss of material for concrete structural components that are accessible. As stated previously in Section 3.5.2.4.1.2 of this SER, the applicant states in LRA Table 3.5-1 that although they are consistent with the GALL Report, they do not consider the aging effects/mechanisms identified by the GALL for concrete to be applicable to concrete structures at FCS. To clarify the applicant’s intent with regard to the aging management of concrete structural components, the staff requested in several RAIs (3.5-1, 3.5.1-7, 3.5.1-12, 3.5.1-15, and 3.5.1-16) that the applicant provide further information regarding this apparent discrepancy. In response, the applicant stated that although they do not consider these aging effects to be applicable, they will manage the aging of concrete structures at FCS as recommended by the GALL Report. Since the applicant clarified its intentions to manage the aging of concrete structures at FCS, the staff considers the RAIs listed above resolved.

For the below-grade concrete portion of the duct banks, the GALL Report recommends aging management only for an aggressive below-grade soil/ground water environment. As stated previously in SER Section 3.5.2.2.2.2, the applicant adequately demonstrated that the ground water chemistry parameters (pH, sulfates, and chlorides) indicate a non-aggressive environment. Therefore, aging management of below-grade concrete components is not warranted. To insure that the below-grade environment remains non-aggressive, the applicant has committed to periodically monitor the ground water chemistry through its SMP.

The staff finds that the applicant’s approach for evaluating the applicable aging effects for concrete components in the duct banks to be reasonable and acceptable. The staff concludes that the applicant has properly identified the aging effects for concrete components in the duct banks.

Steel: Consistent with the recommendations of the GALL Report for the carbon steel manhole flange, the applicant identified loss of material as an applicable aging effect.

The staff finds that the applicant’s approach for evaluating the applicable aging effects for steel components in the duct banks to be reasonable and acceptable. The staff concludes that the applicant has properly identified the aging effects for steel in duct banks.

Cast Iron: For the gray cast iron manhole covers and flange, the applicant identified loss of material as an applicable aging effect. The staff concurs with the identification of loss of material as an applicable aging effect for the gray cast iron manhole covers and flange.

Polyurethane Foam: For the manhole polyurethane foam blocks used as a flood protection barrier, the applicant identified cracking and separation as applicable aging effects. The staff concurs with the identification of these two aging effects for the polyurethane foam blocks.

On the basis of its review, the staff finds the applicant has identified the appropriate aging effects for the materials and environments associated with the duct banks.

Aging Management Programs

Table 3.5-1 through 3.5-3 of the LRA credit the following AMPs with managing the identified aging effects for the duct banks:

- Structures Monitoring Program
- Periodic Surveillance and Preventive Maintenance Program

Each of the above AMPs are credited with managing the aging of several components in several different structures and systems and are, therefore, considered common AMPs. The staff review of the common AMPs is in Section 3.0.3 of this SER.

After evaluating the applicant's AMR for each of the components in the duct banks commodity group, the staff evaluated the AMPs listed above to determine if they are appropriate for managing the identified aging effects. For those components identified in Table 3.5-1 of the LRA, the staff verified that the applicant credited the AMP recommended by the GALL Report. For the components identified in LRA Tables 3.5-2 and 3.5-3, the staff verified that the applicant credited an AMP that is appropriate for the identified aging effect(s).

On the basis of its review, the staff finds the applicant has credited the appropriate AMPs to manage the aging effects for the materials and environments associated with the duct banks. In addition, the staff found the associated program descriptions in the USAR Supplement to be acceptable to satisfy 10 CFR 54.21(d)

3.5.2.4.5.3 Conclusions

The staff has reviewed the information in Sections 2.4 and 3.5 of the LRA, the applicant's responses to the staff's RAIs, and the applicable AMP descriptions in Appendix B of the LRA. On the basis of this review, the staff concludes that the applicant has demonstrated that the aging effects associated with the components in the duct banks commodity group will be adequately managed so that these components will perform their intended functions in accordance with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR Supplement program descriptions and concludes that the USAR Supplements provide adequate program descriptions of the AMPs credited for managing aging in the duct banks to satisfy 10 CFR 54.21(d).

3.5.3 Evaluation Findings

The staff has reviewed the information in Sections 2.4, 3.3, and 3.5 of the LRA. On the basis of its review, the staff concludes that the applicant has demonstrated that the aging effects associated with the containment, structures, and structural components will be adequately managed so that these structures and components will perform their intended functions in accordance with the current licensing basis during the period of extended operation, as required by 10 CFR 54.21(a)(3).

In addition, the staff also concludes that the USAR Supplement contains an appropriate summary description of the programs and activities for managing the effects of aging for the containment, structures, and structural components for the period of extended operation, as required by 10 CFR 54.21(d).

3.6 Electrical and Instrumentation and Controls

This section addresses the aging management of the components of the electrical and instrumentation and control (I&C) systems group. The systems that make up this group are described in the following LRA sections:

- Cables and Connectors (2.5.1)
- Containment Electrical Penetrations (2.5.2)
- Engineered Safeguards (2.5.3)
- Nuclear Instrumentation (2.5.4)
- Reactor Protection System (2.5.5)
- 4160 VAC (2.5.6)
- 480 VAC Bus (2.5.7)
- 480 VAC MCCs (2.5.8)
- 125 VDC (2.5.9)
- 120 VAC (2.5.10)
- Plant Computer - Emergency Response Facility (2.5.11)
- Qualified Safety Parameter Display (2.5.12)
- Radiation Monitoring (2.5.13)
- Electrical Equipment (2.5.14)
- Auxiliary Instrumentation (2.5.15)
- Control Board (2.5.16)
- Diverse Scram System (2.5.17)
- Communications (2.5.18)
- Emergency Lighting (2.5.19)
- Bus Bars (2.5.20)

3.6.1 Summary of Technical Information in the Application

In LRA Section 3.6, ”Aging Management of Electrical and Instrumentation and Controls,” the applicant described its AMRs for the electrical and I&C systems group at FCS.

The description of the electrical and I&C systems can be found in LRA Section 2.5.

The passive, long-lived components that are subject to an AMR are identified as follows:

- Cables and connectors (including splices, fuse blocks , terminal blocks)
- Electrical penetration

- Bus bars

The LRA states that cables and their associated connectors provide electrical energy (either continuously or intermittently) to power various equipment and components throughout the plant. Cables and connectors associated with the EQ program are addressed as short-lived TLAAs and thus are not included in the set of cables and connectors requiring an AMR.

The applicant's AMRs include an evaluation of plant-specific and industry operating experience. The plant-specific evaluation includes reviews of condition reports and discussions with appropriate site personnel to identify aging effects that require management.

These reviews concluded that the aging effects requiring management based on FCS operating experience were consistent with aging effects identified in GALL.

The applicant's review of industry operating experience included a review of operating experience through 2001. The results of this review concluded that aging effects requiring management based on industry operating experience were consistent with aging effects identified in GALL.

The applicant's ongoing review of plant-specific and industry operating experience was conducted in accordance with the FCS operating experience program.

3.6.2 Staff Evaluation

In Section 3.6 of the LRA, the applicant describes its AMRs for electrical and I&C systems at FCS. The staff reviewed LRA Section 3.6 to determine whether the applicant has provided sufficient information to demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB throughout the period of extended operation, in accordance with the requirements of 10 CFR 54.21(a)(3), for electrical and I&C system components that are determined to be within the scope of license renewal and subject to an AMR.

The applicant referenced the GALL Report in its AMR. The staff has previously evaluated the adequacy of the aging management of electrical and I&C system components for license renewal as documented in the GALL Report. Thus, the staff did not repeat its review of the matters described in the GALL Report, except to ensure that the material presented in the LRA was applicable, and to verify that the applicant had identified the appropriate programs as described and evaluated in the GALL Report.

In LRA Section 2.5, the applicant provided brief descriptions of the electrical and I&C systems, and summarized the results of its AMRs of the electrical and I&C system components at FCS in LRA Section 3.6.

Table 3.6-1 below provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.6 that are addressed in the GALL Report.

Table 3.6-1

Staff Evaluation Table for FCS Electrical Components Evaluated in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Electrical equipment subject to 10 CFR 50.49 environmental qualification (EQ) requirements	Degradation due to various aging mechanisms	Environmental qualification of electrical components	EQ Program	Consistent with GALL. GALL recommends further evaluation (See Section 3.6.2.2 below)
Electrical cables and connections not subject to 10 CFR 50.49 EQ requirements	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR); electrical failure caused by thermal/thermoxidative degradation of organics; radiolysis and photolysis (ultraviolet [UV] sensitive materials only) of organics; radiation-induced oxidation; moisture intrusion	Aging management program for electrical cables and connections not subject to 10 CFR 50.49 EQ requirements	AMP consistent with GALL AMP XI.E1	Consistent with GALL. (See Section 3.6.2.3.1.2 below)
Electrical cables used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements that are sensitive to reduction in conductor insulation resistance (IR)	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced IR; electrical failure caused by thermal/thermoxidative degradation of organics; radiation-induced oxidation; moisture intrusion	Aging management program for electrical cables used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements	AMP consistent with GALL AMP XI.E2	Consistent with GALL (See Section 3.6.2.3.1.2 below)
Inaccessible medium-voltage (2 kV to 15 kV) cables (e.g., installed in conduit or direct buried) not subject to 10 CFR 50.49 EQ requirements	Formation of water trees, localized damage leading to electrical failure (breakdown of insulation); water trees caused by moisture intrusion	Aging management program for inaccessible medium-voltage cables not subject to 10 CFR 50.49 EQ requirements	AMP consistent with GALL AMP XI.E3	Consistent with GALL (See Section 3.6.2.3.1.2 below)
Electrical connectors not subject to 10 CFR 50.49 EQ requirements that are exposed to borated water leakage	Corrosion of connector contact surfaces caused by intrusion of borated water	Boric acid corrosion	Boric acid corrosion prevention	Consistent with GALL (See Section 3.0.3.6 below)

The staff's review of the electrical and I&C systems group for the FCS LRA is contained within four sections of this SER. Section 3.6.2.1 is the staff review of components in the electrical and I&C systems that the applicant indicates are consistent with GALL and do not require further evaluation. Section 3.6.2.2 is the staff review of components in the electrical and I&C systems that the applicant indicates are consistent with GALL and GALL recommends further evaluation.

Section 3.6.2.3 is the staff evaluation of aging management programs that are specific to the electrical and I&C components. Section 3.6.2.4 contains an evaluation of the adequacy of aging management for components in each system in the electrical and I&C systems group.

3.6.2.1 Aging Management Evaluations in the GALL Report that Are Relied on for License Renewal, Which Do Not Require Further Evaluation

For component groups evaluated in GALL for which the applicant has claimed consistency with GALL, and for which GALL does not recommend further evaluation, the staff sampled components in these groups during the AMR inspection to determine whether the plant-specific components contained in these GALL component groups are bounded by the GALL evaluation. The staff also sampled component groups during the AMR inspection to determine whether the applicant had properly identified those component groups in GALL that are not applicable to its plant. The results of the staff's AMR inspection can be found in AMR Inspection Report 50-285/03-07, dated March 20, 2003.

On the basis of its review of the inspection results, the staff finds that the applicant's claim of consistency with GALL is acceptable, and that it is acceptable for the applicant to reference the information in the GALL Report for electrical and I&C components. Therefore, on this basis, the staff concludes that the applicant has demonstrated that the components for which the applicant claimed consistency with GALL 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) and that the USAR Supplement provides an adequate summary description of the programs and activities credited for managing the effects of aging for the ESF system components for which the applicant claimed consistency with GALL, as required by 10 CFR 54.21(d).

3.6.2.2 Electrical Equipment Subject to Environmental Qualification

As stated in the SRP-LR, environmental qualification is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The environmental qualification TLAA is discussed in LRA Section 4.4. The staff reviewed the evaluation of this TLAA separately in Section 4.4 of this SER, following the guidance in Section 4.4 of the SRP-LR.

3.6.2.3 Aging Management Programs for Electrical and I&C Components

In SER Section 3.6.2.1, the staff determined that the applicant's AMRs and associated AMPs will adequately manage component aging in electrical and I&C systems. The staff then reviewed specific electrical and I&C system components to ensure that they were properly evaluated in the applicant's AMR.

To perform its review, the staff reviewed the components listed in tables in LRA Sections 2.5.1-1 through 2.5.20-1 to determine whether the applicant had properly identified the applicable AMRs and AMPs needed to adequately manage the aging effects for the components. This portion of the staff review involved identification of the aging effects for each component, ensuring that each aging effect was evaluated using the appropriate AMR in Section 3, and that management of the aging effect was captured in the appropriate AMP. The results of the staff's review are provided below.

The staff also reviewed the USAR Supplement for the AMPs credited with managing aging in electrical and I&C system components to determine whether the program descriptions adequately describe the programs.

The applicant credits two AMPs to manage the aging effects associated with electrical and I&C components. The boric acid corrosion prevention program is credited with managing aging in components in other system groups (common AMPs) while the non-EQ AMP is credited with managing aging only for electrical and I&C components. The staff's evaluation of the boric acid corrosion prevention program is provided in Section 3.0.3.6 of this SER.

The staff's evaluation of the non-EQ cable AMP is provided here.

3.6.2.3.1 Non-EQ Cable Aging Management Program

3.6.2.3.1.1 Summary of Technical Information in the Application

In LRA Section B.3.4, "Non-EQ Cable Aging Management Program," the applicant provides its AMP to manage aging in electrical cables and connectors not subject to 10 CFR 50.49 and the electrical cables used in instrumentation circuits not subject to 10 CFR 50.49. The LRA states that the FCS non-EQ cable AMP establishes a service life value for the non-EQ cable in a similar fashion as the FCS EQ program establishes a qualified life for safety-related equipment. Non-EQ cable was purchased to the same requirements and specifications as that included in the EQ program for the cable installed and qualified under the EQ program. Additional temperature and environmental data utilized to extend the qualified life of the EQ equipment and cable will be utilized to analyze and establish a service life for the non-EQ cables. These analyses are relied upon to predict the life expectancy of the non-EQ cables under the normal and abnormal plant operating conditions. Cables not capable of having a 60-year service life will be further analyzed using state of the art analytical techniques to determine if the service life can be further extended. Industry-accepted and regulatory-approved cable inspection techniques that provide aging related data, as well as state-of-the-art in-situ, non-destructive testing of cable performance, and/or laboratory testing of cable to extend life, may also be considered should the aforementioned methodologies not succeed in extending the required service life.

3.6.2.3.1.2 Staff Evaluation

The staff reviewed the applicant's non-EQ cable AMP credited for the aging management of insulated cables and connections at FCS. The staff's evaluation includes a review of the aging effects considered. The staff reviewed this section of the LRA to determine whether the applicant has demonstrated that the effects of aging on cables will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR Supplement for this AMP to determine whether it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

The staff noticed that although the applicant referenced GALL as an AMP, all the elements of the AMP were not consistent with GALL. Therefore, the staff was unclear how the proposed AMP will manage aging of electrical components that are within the scope of the license renewal and subject to an AMR, but that are not subject to 10 CFR 50.49 environmental qualification requirements (including those used in instrument circuits as well as inaccessible medium voltage cables). In addition, for inaccessible medium-voltage (2 kV to 15 kV) cables (e.g., installed in conduit or direct buried) not subject to 10 CFR 50.49 EQ requirements, no aging program was proposed by the applicant. The LRA stated that modifications were made to the duct banks for inaccessible non-EQ medium voltage cables to preclude moisture intrusion; therefore there is no aging effect requiring management. However, it was not clear to the staff what periodic actions will be taken during the period of extended operation to assure that the modifications made to prevent inaccessible non-EQ medium-voltage cables from being exposed to significant moisture will remain intact. By letter dated October 11, 2002, the staff issued RAI B.3.4-1, requesting the applicant to clarify the following three items:

1. How will the non-EQ aging management program manage aging in accessible and inaccessible electrical cables and connections that are within the scope of license renewal and subject to an AMR, but are not subject to the environmental qualification requirements of 10 CFR 50.49 and that are exposed to adverse localized conditions caused by radiation, temperature or moisture, such that the cables and connectors will perform their intended functions in accordance with the current licensing basis through the period of extended operation?

2. How will the non-EQ aging management program manage aging in accessible and inaccessible electrical cables and connectors that are within the scope of license renewal and subject to an AMR and are exposed to adverse localized conditions caused by radiation, temperature or moisture, and that are used in circuits with sensitive, low-level signals, but that are not subject to the environmental qualification requirements of 10 CFR 50.49, such that the cables will perform their intended functions in accordance with the current licensing basis through the period of extended operation?

3. How will the non-EQ aging management program manage aging in inaccessible medium voltage cables that are within the scope of license renewal and subject to an AMR, and are exposed to adverse localized environments caused by moisture while energized, but are not subject to the environmental qualification requirements of 10 CFR 50.49, such that the cables will perform their intended functions in accordance with the current licensing basis through the period of extended operation?

In a letter dated December 19, 2002, the applicant responded to RAI B.3.4-1, stating that, for non-EQ cables and connections within the scope of license renewal and subject to an aging management review

1. Prior to period of extended operation, OPPD will implement a program and inspection consistent with that described in XI.E.1 of the GALL Report.

2. Prior to period of extended operation, OPPD will implement a program and inspection consistent with that described in XI.E.2 of the GALL Report.

3. In response to this item, the applicant stated that in 1994, during an inspection of the cable vault/manhole, it was discovered that moisture ingress around the manhole was causing some of the conduits to corrode. A section of boat foam was added around the conduit nest to preclude water from seeping in through the manhole cover to further corrode the conduit. Additionally, the manhole was sealed.

Medium voltage cables (six shutdown circuits) are routed through the vault and into duct banks from the intake structure to the service building. Although medium voltage cables are routed through the duct banks, by design, they will not accumulate standing water; duct banks are pitched at a minimum of 1/8 inch per foot. The applicant stated that in 30 years, it has not had a cable failure, and committed to implementing a program and inspection consistent with that described in XI.E3 of the GALL Report. The staff found the applicant's response to RAI B.3.4-1 satisfactory.

The staff reviewed the USAR Supplement for the non-EQ cable AMP as described in the LRA and found that the supplement did not provide an adequate description of the revised program, as required by 10 CFR 54.21(d). The AMP provided in the LRA reflected the program as originally envisioned by the applicant. As discussed above, the applicant has committed to revising the AMP to reflect the positions in GALL Report Sections XI.E1, XI.E2, and XI.E3. As a result, the description of the AMP in the USAR Supplement must be revised to reflect the descriptions of XI.E1, XI.E2, and XI.E3. The applicant was requested to submit to the staff a revised USAR Supplement that is consistent with the descriptions for GALL AMPs XI.E1, XI.E2, and XI.E3 and satisfies 10 CFR 54.21(d). This was identified as Open Item 3.6.2.3.1.2-1.

By letter dated July 7, 2003, the applicant submitted the following revised USAR Supplement Section A.2.15 description that supersedes the Section A.2.15 in the LRA.

> **A.2.15 Non-EQ Cable Aging Management Program**
>
> The FCS Non-EQ Cable Aging Management Program is a new program that provides aging management of (1) non-environmentally qualified electrical cables and connections exposed to an adverse localized environment caused by heat, radiation, or moisture; (2) non-environmentally qualified electrical cables used in instrumentation circuits that are sensitive to reduction in conductor insulation resistance, and are exposed to an adverse localized environment caused by heat, radiation, or moisture; and (3) non-environmentally qualified inaccessible medium-voltage cables exposed to an adverse localized environment caused by moisture and voltage exposure.
>
> Aging management is provided by the following actions:
>
> 1. Accessible electrical cables and connections installed in adverse localized environments will be inspected prior to the period of extended operation and at least once every 10 years for cable and connector jacket surface anomalies, such as embrittlement, discoloration, cracking, swelling, or surface contamination.
>
> 2. Electrical cables used in circuits with sensitive, low-level signals, such as radiation monitoring and nuclear instrumentation, are tested as part of the instrumentation loop calibration at the normal calibration frequency.
>
> 3. In-scope medium voltage cables exposed to significant moisture and significant voltage will be tested prior to the period of extended operation and at least once every 10 years to provide an indication of the condition of the conductor insulation. The test will be a state-of-the-art test at the time the test is performed.
>
> This program considers the technical information and guidance provided in NUREG/CR-5643, IEEE Std. P1205, SAND96-0344, EPRI TR-109619, and EPRI TR-103834-P1-2.

The staff reviewed the above information and finds that the revised USAR Supplement provides an adequate summary description of the revised Non-EQ Aging Management Program and that the program is consistent with GALL Programs XI.E1, XI.E2, and XI.E3. Open Item 3.6.2.3.1.2-1 is closed.

3.6.2.3.1.3 Conclusion

On the basis of its review and inspection of the applicant's program, including the applicant's commitment to implement a program and inspection consistent with GALL, the staff finds that those portions of the program for which the applicant claims consistency with GALL will be consistent with GALL. The staff also reviewed the USAR Supplement for this AMP and finds that the USAR Supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Therefore, on the basis of its review, the staff concludes that with the applicant's commitment to develop an AMP consistent with GALL AMPs XI.E1, XI.E2, and XI.E3, the applicant has demonstrated that the non-EQ cable program will effectively manage aging in the components for which this program is credited, so that the intended functions of the associated components and systems will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.2.4 Aging Management Review of Plant-Specific Electrical Components

In this section of the SER, the staff presents its review of the applicant's AMRs for specific electrical components. To perform its evaluation, the staff reviewed the components listed in LRA Tables 2.5.1-1, 2.5.2-1, and 2.5.20-1, to determine whether the applicant properly identified the applicable aging effects and AMPs needed to adequately manage these aging effects. This portion of the staff's review involved identification of the aging effects for each component, ensuring that each aging effect was evaluated in the appropriate LRA AMR table in Section 3, and that management of the aging effect was captured in the appropriate AMP.

The results of the staff's review are provided below.

3.6.2.4.1 <u>Cables and Connectors</u>

3.6.2.4.1.1 Summary of Technical Information in the Application

The AMR results for cables and connectors are presented in LRA Table 3.6-1. All electrical and I&C components within the scope of license renewal and subject to an AMR were addressed in the GALL Report. The applicant used the GALL Report format to present its AMR of electrical and I&C components in LRA Table 3.6-1.

As described in LRA Section 2.5.1, cables and connectors provide electrical energy (either continuously or intermittently) to power various equipment and components throughout the plant. Cables and connectors associated with the EQ program are addressed either as short-lived and periodically replaced, or as long-lived TLAAs. As such, they are not included in the set of cables and connectors requiring additional aging management.

Aging Effects

The LRA identifies the following aging effects for cables and connectors:

- degradation due to various aging mechanisms
- embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR)
- electrical failure caused by thermal/thermoxidative degradation of organics
- radiolysis and photolysis (ultraviolet-sensitive materials only) of organics
- radiation-induced oxidation
- moisture intrusion
- formation of water trees; localized damage leading to electrical failure (breakdown of insulation) caused by moisture intrusion and water trees
- corrosion of connector contact surfaces caused by intrusion of borated water

The applicant credited the following AMPs and TLAA with managing the identified aging effects for cables and connectors:

- Boric Acid Corrosion Prevention Program (B.2.1)
- Non-EQ Cable Aging Management Program (B.3.4)
- EQ TLAA

A description of the AMPs is provided in Appendix B of the LRA. The EQ TLAA is described in LRA Section 4.4.

3.6.2.4.1.2 Staff Evaluation

In addition to LRA Section 3.6, the staff reviewed the pertinent information in LRA Section 2.5.1, the applicable AMP descriptions provided in LRA Appendix B, and the EQ TLAA, to determine whether the aging effects associated with cables and connectors have been properly identified and will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR Supplements for the AMPs credited with managing aging in cables and connectors, as well as the USAR Supplement that describes the TLAA, to determine whether they provide adequate summary descriptions of the programs and TLAA, as required by 10 CFR 54.21(d).

This section of the SER provides the staff's evaluation of the applicant's AMRs for the aging effects and the appropriateness of the programs credited for the aging management of cables and connectors at FCS. The staff's evaluation includes a review of the aging effects considered and the basis for the applicant's elimination of certain aging effects. In addition, the staff has evaluated the appropriateness of the AMPs that are credited for managing the identified aging effects for cables and connectors.

Aging Effects

As discussed above, the applicant identified the following aging effects for electrical and I&C components at FCS:

- degradation due to various aging mechanisms
- embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR)
- electrical failure caused by thermal/thermoxidative degradation of organics
- radiolysis and photolysis (ultraviolet-sensitive materials only) of organics
- radiation-induced oxidation
- moisture intrusion
- formation of water trees; localized damage leading to electrical failure (breakdown of insulation) caused by moisture intrusion and water trees
- corrosion of connector contact surfaces caused by intrusion of borated water

The staff reviewed the information in LRA Table 3.6-1 for cables and connectors. On the basis of its review, the staff concludes that the aging effects identified for the subject components are consistent with the aging effects evaluated in the GALL Report and, therefore, are acceptable.

The staff also reviewed the applicant's response to the staff's RAI, discussed below.

For inaccessible medium-voltage (2 kV - 15 kV) cables (e.g., installed in conduit or direct buried) not subject to EQ requirements, LRA Table 3.6-1, Item 3.6.1.04, states that modifications were made to the duct banks to preclude moisture intrusion and, therefore, there are no aging effects requiring management. It was not clear to the staff what actions will be taken to assure that the modifications made to prevent inaccessible non-EQ medium-voltage cables from being exposed to significant moisture will be maintained during the period of extended operation. By letter dated October 11, 2002, the staff issued RAI 3.6-1, requesting the applicant to provide a description of the program that will assure that the modifications are maintained to prevent water intrusion into the duct banks, and to provide a description of the AMP that will be relied on for inaccessible medium-voltage cables installed in conduit, cable trenches, cable troughs, underground vaults, or direct buried installations.

By letter dated December 19, 2002, the applicant responded to RAI 3.6-1 by noting that the information requested by the staff could be found in the applicant's responses to RAIs 2.5-1 and B.3.4-1, both of which were provided in the same response letter.

In its response to RAI 2.5-1, the applicant stated that there are no medium-voltage cables in the substation switchyard associated with station blackout (SBO). Medium voltage SBO cables in the plant have been addressed as part of the cable commodity group, and include cables associated with the 4160 VAC system. Low-voltage (typically 120 V) cable is located in troughs and duct banks. High-voltage cable is located overhead on towers (single phase). The arrangement of the duct banks is such that they are pitched/sloped at no less than 1/8 in per foot to maintain cable out of long-term water immersion by preventing standing water.

In its response to Part 3 of RAI B.3.4-1 concerning aging management of inaccessible medium-voltage electrical cables exposed to adverse localized environments caused by moisture while energized, but are not within the EQ program, the applicant stated that in 1994, during an inspection of a cable vault/manhole containing these cables, it was discovered that moisture had entered through the manhole and was causing some of the cable to corrode. To correct the problem, the applicant applied boat foam around the conduit to preclude water from seeping in through the manhole cover. Additionally, the manhole was sealed. Six medium-voltage safe shutdown circuits are routed through the vault and into duct banks from the intake structure to the service building. Although medium-voltage cables are routed through the duct banks, the duct banks are designed to prevent the accumulation of standing water. The duct banks are pitched at a minimum 1/8 inches per foot. In 30 years, the applicant has not had a cable failure; however, to ensure that the cables susceptible to potentially wetted condition will not deteriorate, the applicant committed to implementing a program and inspection consistent with that described in Section XI.E3 of the GALL Report.

On the basis of the applicant's responses contained in RAIs 2.5-1 and B.3.4-1, the staff finds that the applicant has identified the applicable aging effects for the cables and connectors at FCS.

Aging Management Programs

The applicant credited the following AMPs and TLAA for managing the aging effects for cables and connectors:

- Boric Acid Corrosion Prevention Program (3.0.3.6)
- Non-EQ Cable Aging Management Program (3.6.2.3.1)
- EQ TLAA

The boric acid corrosion program is credited for managing the aging effects of components in several systems and structures and, therefore, is considered a common AMP. The staff has evaluated this common AMP and found it to be acceptable for managing the aging effects identified for this system. This AMP is evaluated in Section 3.0.3.6 of this SER.

With regard to the non-EQ AMP provided in LRA Section B.3.4, the staff was concerned that the applicant's AMP was not consistent with GALL AMPs XI.E1, XI.E2, and XI.E3, which provide guidance on the management of non-EQ cables within the scope of license renewal and subject to an AMR. By letter dated October 11, 2002, the staff issued RAI B.3.4-1, requesting the applicant to describe how the non-EQ AMP will manage the aging effects associated with non-EQ cables.

By letter dated December 19, 2002, the applicant responded to RAI B.3.4-1, by committing to develop, prior to the period of extended operation, AMPs that are consistent with GALL AMPs XI.E1, XI.E2, and XI.E3. The staff finds this commitment acceptable because implementation of AMPs consistent with the GALL AMPs will ensure that non-EQ cables within the scope of license renewal and subject to an AMR, and that experience the subject aging effects, will be adequately managed during the period of extended operation. The staff's review of this issue can be found in Section 3.6.2.3.1.2 of this SER.

Aging management of environmentally-qualified cables and connectors will continue to be performed through the applicant's EQ program, which is identified as a TLAA for license renewal. The staff's evaluation of the applicant's EQ TLAA can be found in Section 4.4 of this SER.

On the basis of its review, including the applicant's responses to the staff's RAIs, the staff concludes that the above identified AMPs and TLAA will effectively manage the aging effects associated with cables and connectors.

The staff also reviewed the applicable USAR Supplement program descriptions and concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in cables and connectors to satisfy 10 CFR 54.21(d).

3.6.2.4.1.3 Conclusion

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects and, with the fulfillment of the commitments identified in Section 3.6.2.4.1.2 above, will have adequate AMPs and TLAAs for managing the aging effects for cables and connectors, such that the component 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 USAR Supplement program descriptions and concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in cables and connectors to satisfy 10 CFR 54.21(d).

3.6.2.4.2 Containment Electrical Penetrations

3.6.2.4.2.1 Summary of Technical Information in the Application

The AMR results for containment electrical penetrations are presented in LRA Table 3.6-1. All electrical and I&C components within the scope of license renewal and subject to an AMR were addressed in the GALL Report. The applicant used the GALL Report format to present its AMR of electrical and I&C components in LRA Table 3.6-1.

As described in LRA Section 2.5.4, electrical penetrations are containment boundary components that provide electrical energy across the containment boundary (either continuously or intermittently) to power various equipment and components throughout the plant. The electrical penetration provides an electrical connection between two sections of the electrical/I&C circuit. The pigtail at each end of the penetration is connected to the field cable in various ways. The boundary for the electrical penetrations includes the pigtail cable. Penetrations associated with the EQ program are addressed either as short-lived and periodically replaced, or as long-lived TLAAs.

Aging Effects

The LRA identifies the following aging effects for containment electrical penetrations:

- degradation due to various aging mechanisms
- embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR)
- electrical failure caused by thermal/thermoxidative degradation of organics
- radiolysis and photolysis (ultraviolet-sensitive materials only) of organics
- radiation-induced oxidation
- moisture intrusion
- corrosion of connector contact surfaces caused by intrusion of borated water
- loss of material due to corrosion for penetration sleeves, penetration bellows, and dissimilar metal welds

The applicant credited the following AMPs and TLAA with managing the identified aging effects for containment electrical penetrations:

- Containment ISI Program (B.1.3)
- Containment Leak Rate Program (B.1.4)
- Boric Acid Corrosion Prevention Program (B.2.1)
- Non-EQ Cable Aging Management Program (B.3.4)
- EQ TLAA

A description of the AMPs is provided in Appendix B of the LRA. The EQ TLAA is described in LRA Section 4.4.

3.6.2.4.2.2 Staff Evaluation

In addition to LRA Section 3.6, the staff reviewed the pertinent information in LRA Section 2.5.2, the applicable AMP descriptions provided in LRA Appendix B, and the EQ TLAA, to determine whether the aging effects associated with containment electrical penetrations have been properly identified and will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR Supplements for the AMPs credited with managing aging in cables and connectors, as well as the USAR Supplement that describes the TLAA, to determine whether they provide adequate summary descriptions of the programs and TLAA, as required by 10 CFR 54.21(d).

This section of the SER provides the staff's evaluation of the applicant's AMRs for the aging effects and the appropriateness of the programs credited for the aging management of containment electrical penetrations at FCS. The staff's evaluation includes a review of the aging effects considered. In addition, the staff has evaluated the appropriateness of the AMPs that are credited for managing the identified aging effects for containment electrical penetrations.

Aging Effects

The LRA identifies the following aging effects for the containment electrical penetrations:

- degradation due to various aging mechanisms
- embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR)
- electrical failure caused by thermal/thermoxidative degradation of organics
- radiolysis and photolysis (ultraviolet-sensitive materials only) of organics
- radiation-induced oxidation
- moisture intrusion
- corrosion of connector contact surfaces caused by intrusion of borated water
- loss of material due to corrosion for penetration sleeves, penetration bellows, and dissimilar metal welds

In LRA Table 2.5.2-1, the applicant identifies the containment electrical penetrations as components that are within the scope of license renewal and subject to AMR. In this table, the applicant identifies several links, including 3.6.1.01 and 3.6.1.02 in LRA Table 3.6-1. The staff believes that the electrical penetrations may include low-level instrument cable pigtails, which require aging management identified in LRA Table 3.6-1, link 3.6.1.03. By letter dated February 20, 2003, the staff issued POI-12, requesting the applicant to clarify whether low-level instrument cable pigtails are included in the containment electrical penetrations and whether they will be managed by the non-EQ cable AMP. By letter dated March 14, 2003, the applicant responded to POI-12 by stating that LRA Table 2.5.2-1 has been revised to include the containment type “Instrument Cable Pigtails,” that have an intended function of “Electrical Continuity,” and are linked to LRA AMR Item 3.6.1.03. These components will, therefore, be managed for aging by the non-EQ cable AMP. A revision to LRA Table 2.5.2-1 was included in the applicant’s response. The staff finds this acceptable, and POI-12 is resolved.

On the basis of its review, including the applicant’s response to POI-12, the staff finds that the applicant has identified the applicable aging effects for the containment electrical penetrations at FCS.

Aging Management Programs

The applicant credited the following AMPs and TLAA for managing the aging effects for containment electrical penetrations:

- Containment ISI Program (3.0.3.3)
- Boric Acid Corrosion Prevention Program (3.0.3.6)
- Containment Leak Rate Program (3.5.2.3.1)
- Non-EQ Cable Aging Management Program (3.6.2.3.1)
- EQ TLAA

The containment ISI and boric acid corrosion programs are credited for managing aging effects of components in several systems and structures and, therefore, are considered common AMPs. The staff has evaluated these common AMPs and found them to be acceptable for managing the aging effects identified for this system. These AMPs are evaluated in Sections 3.0.3.3 and 3.0.3.6 of this SER, respectively.

As discussed in Section 3.6.2.3.1.2 above, the applicant committed to develop, prior to the period of extended operation, an AMP to manage non-EQ electrical components consistent with GALL AMPs XI.E1, XI.E2, and XI.E3. The staff considers this commitment adequate to ensure that the containment electrical penetrations will be adequately managed during the period of extended operation.

Aging management of environmentally-qualified containment electrical penetrations will continue to be performed through the applicant's EQ program, which is identified as a TLAA for license renewal. The staff's evaluation of the applicant's EQ TLAA can be found in Section 4.4 of this SER.

On the basis of its review, the staff concludes that the above identified AMPs and TLAA will effectively manage the aging effects associated with the containment electrical penetrations.

The staff also reviewed the applicable USAR Supplement program descriptions and concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in containment electrical penetrations to satisfy 10 CFR 54.21(d).

3.6.2.4.2.3 Conclusions

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and, with the fulfillment of the commitments identified in Section 3.6.2.4.2.2 above, will have adequate AMPs and TLAAs for managing the aging effects for containment electrical penetrations, such that the component 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 USAR Supplement program descriptions and concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in containment electrical penetrations to satisfy 10 CFR 54.21(d).

3.6.2.4.3 Bus Bars

3.6.2.4.3.1 Summary of Technical Information in the Application

Electrical buses electrically connect specified sections of an electrical circuit to deliver voltage or current (either continuously or intermittently) to various equipment and components throughout the plant. The standoffs support the electrical bus bars.

In LRA Section 2.5.20, the applicant states that there are no electrical buses or associated standoffs within the scope of license renewal that are included in the 10 CFR 50.49 program.

Aging Effects

In LRA Section 2.5.20, the applicant has identified the bus bars and standoffs as passive, long-lived components that are within the scope of the license renewal and subject to an AMR, and has concluded that these components have no aging effects that require management. The applicant's AMR results for these items show that no aging effects requiring management were identified for this group.

Aging Management Programs

Because the applicant did not identify any aging effects requiring management for the bus bars and bus bar standoffs, no AMPs are credited for managing aging.

3.6.2.4.3.2 Staff Evaluation

The staff reviewed the AMR results for the aging management of bus bars and standoffs at FCS to determine whether the applicant has demonstrated that the effects of aging on bus bars and standoffs will be adequately managed during the period of extended operation, as required by 10 CFR 54.21(a)(3).

The bus bars are a pre-assembled raceway design, with bus bars mounted on insulated supports (standoffs). The intended function of the standoffs is to support the electrical bus bars.

Aging Effects

The LRA stated that there are no aging effects requiring management for the electrical bus bars and bus bar standoffs. As discussed in Section 2.5.2.5.2 of this SER, the staff issued POI-6(b) requesting the applicant to provide information on the components' materials and environments, along with the basis for concluding that these components have no plausible aging effects. By letter dated March 14, 2003, the applicant responded to POI-6(b), stating the following:

> The bus bar materials are copper and aluminum; their environment is in indoor air and outdoor air. In accordance with EPRI TR-114882, Non-Class1 Mechanical Implementation Guideline and Mechanical Tools, Revision 2, 1999, no aging effects were identified for aluminum, aluminum alloys, copper, or copper alloys (brass, bronze) in an indoor or outdoor air environment.
>
> The stand offs include fiberglass reinforced polyester resin and porcelain materials that are in ambient air external environment and are not continuously wetted. Internal environments are not applicable.
>
> Table 7-17 of EPRI NP-1558, A Review of Equipment Aging Theory and Technology, lists the continuous use temperature of plastics. The continuous use temperature[(a)] listed for polyester with 40% glass content is 266 °F[(b)] (compared with the bounding temperature value of 122 °F). Applying the Arrhenius methodology, it is clear that fiberglass reinforced polyester is acceptable. Figure C-2 of EPRI NP-1558 contains the relative radiation stability of thermosetting resins. The threshold for gamma radiation for polyester (glass filled) is 1,000,000,000 Rads (compared with the bounding 60-year radiation dose of less than 1,000 Rads).
>
> (a) Continuous use temperatures were determined as the temperatures corresponding to 100,000 hours (11.4 years) on the Arrhenius curve of the material for an endpoint of 50% reduction in tensile strength.
>
> (b) Based on retention of tensile strength taken at 500 degrees F.

On the basis of its review of the applicant's response to POI-6(b), the staff was concerned that the applicant may not have considered all the aging effects of the bus bars/ducts. The staff discussed this issue with the applicant, pointing out that industry experience has indicated several problems with the bus bar/duct, such as loosening of splice plate bolts, degradation of Noryl insulation, presence of moisture or debris, oxidation of aluminum electrical connections, and corrosion of metallic components. On the basis of this experience, the staff requested that the applicant provide a description of the AMP used to detect the above aging effects, or provide justification why such a program is not needed. This was identified as Open Item 3.6.2.4.3.2-1.

By letter dated July 7, 2003, the applicant responded to Open Item 3.6.2.4.3.2-1, stating that when scoping and screening were performed for bus bars at FCS, as a conservative measure, all bus bars were included within the scope of license renewal, with the exception of those associated with SBO. SBO beyond the plant boundary was added later in response to a staff RAI and the NRC ISG on SBO. All of the in-plant bus bars are inside the enclosure of an active component, such as switchgear, power supplies, etc., and are considered to be piece parts of the larger assembly. Per 10 CFR 54.21, OPPD considers them not to be subject to an AMR.

The applicant stated that the SBO restoration buses (nonsegregated and iso-phase) are fed from the 161 Kv and 345 Kv transmission lines from the switchyard primary side of the transformers (auxiliary and main) and connect to the plant from the secondary side of the transformers by bus work (non-segregated from the auxiliary transformers and isophase from the main). The isophase bus, which is an aluminum tube contained in a tube-like aluminum enclosure, connects the main transformer to the main generator and to the unit auxiliary transformers. The isophase bus is continuously air-cooled and no moisture accumulation has ever been observed. The isophase bus connects from the main to the auxiliary transformers with bolted connections. The connections of the buses to the transformers are inspected and greased periodically in accordance with OPPD Substation Maintenance Department procedures. The inspections are performed on a “train outage schedule” (i.e., in one refueling outage, one bus is inspected and during the next outage, the other bus is inspected).

The auxiliary transformers utilize nonsegregated copper buses to connect to the 4160-volt distribution system. Use of flexible copper buses minimizes the effects of vibration from end devices. The connections of the buses to the transformers are inspected and greased periodically in accordance with OPPD Substation Maintenance Department procedures. The nonsegregated bus work is insulated. However, past inspections of this area revealed peeling or flaking of the insulation (inspections were performed during the early- to mid- 1970s, prior to implementation of the current Corrective Action Program). To preclude further degradation, OPPD taped a good portion of the non-segregated buses, including the affected areas. The taping was done with Bishops High Voltage tape, with the ends taped off with Scotch 88 tape. OPPD inspects these buses on a "train outage schedule." These buses are inspected using a plant maintenance procedure which inspects the bus and the switchgear cubicles associated with that bus.

The bus bars credited in the SBO restoration path are all connected to the auxiliary transformers by bolted connections. The aging of the bolted connections is managed through implementation of the OPPD Periodic Surveillance and Preventive Maintenance Program. The OPPD substation maintenance crew periodically inspects all bolted connections. The torque values of the bolted connections are also periodically checked. Routine inspection and cleaning of the buses by Substation Maintenance Department and FCS Maintenance Department crews preclude the buildup of any dirt or debris or the existence of loose bolting.

The description of the Periodic Surveillance and Preventive Maintenance Program in LRA Section A.2.18 (the USAR Supplement) is not at the level of detail that warrants mention of bus bar aging management, therefore, this section has not been revised. However, OPPD has revised the Periodic Surveillance and Preventive Maintenance Program description in LRA Section B.2.7 to include Substation–SBO Restoration in the program scope. The program’s activities also check bus connectors for loss of torque and degradation of insulation wrap. The revised LRA Section B.2.7 is provided below.

B.2.7 Periodic Surveillance And Preventive Maintenance (PM) Program

The stated purpose of the PM program is to prevent or minimize equipment breakdown and to maintain equipment in a condition that will enable it to perform its normal and emergency functions. The program and the site administrative control processes provide for a systematic approach in establishing the method, frequency, acceptance criteria, and documentation of results.

The FCS Periodic Surveillance and Preventive Maintenance Program consists of periodic inspections and tests that are relied on to manage aging for system and structural components and that are not evaluated as part of the other aging management programs addressed in this appendix. The preventive maintenance and surveillance testing activities are implemented through periodic work orders that provide for assurance of functionality of the components by confirmation of integrity of applicable parameters.

EVALUATION AND TECHNICAL BASIS

(1) Scope of Program:

The FCS Periodic Surveillance and Preventive Maintenance Program provides for periodic inspection and testing of components in the following systems and structures.

- Auxiliary Building
- Auxiliary Building HVAC
- Auxiliary Feedwater
- Chemical and Volume Control
- Component Cooling
- Containment
- Containment HVAC
- Control Room HVAC and Toxic Gas Monitoring
- Diesel Generator Lube Oil
- Containment Penetration, and System Interface Components for Non-CQE Systems
- Emergency Diesel Generators
- Fire Protection
- Fuel Handling Equipment/Heavy Load Cranes
- Intake Structure
- Liquid Waste Disposal
- Duct Banks
- Reactor Coolant
- Safety Injection and Containment Spray
- Ventilating Air
- Substation – SBO Restoration

(2) Preventive Actions:

The Periodic Surveillance and Preventive Maintenance Program includes periodic refurbishment or replacement of components, which could be considered to be preventive or mitigative actions. The inspections and testing to identify component aging degradation effects do not constitute preventive actions in the context of this element.

(3) Parameters Monitored or Inspected:

Inspection and testing activities monitor parameters including surface condition, loss of material, presence of corrosion products, signs of cracking and presence of water in oil samples.

(4) Detection of Aging Effects:

Preventive maintenance and surveillance testing activities provide for periodic component inspections and testing to detect the following aging effects and mechanisms:

- Change in Material Properties
- Cracking
- Fouling
- Degradation of insulation wrap
- Loss of Material
- Loss of Material – Crevice Corrosion
- Loss of Material – Fretting
- Loss of Material – General Corrosion
- Loss of Material - Pitting Corrosion
- Loss of Material - Pitting/Crevice/Gen. Corrosion
- Loss of Material – Wear
- Separation
- Loss of Torque

The extent and schedule of the inspections and testing assures detection of component degradation prior to the loss of their intended functions. Established techniques such as visual inspections and dye penetrant testing are used.

(5) Monitoring and Trending:

Preventive maintenance and surveillance testing activities provide for monitoring and trending of aging degradation. Inspection intervals are established such that they provide for timely detection of component degradation. Inspection intervals are dependent on the component material and environment and take into consideration industry and plant-specific operating experience and manufacturers' recommendations.

The program includes provisions for monitoring and trending with the stated intent of identifying potential failures or degradation and making adjustments to ensure components remain capable of performing their functions. PM review and update guidelines are provided that include adjustment of PM task and frequency based on the as-found results of previous performance of the PM. In particular, responsible system engineers are required to periodically review the results of preventive maintenance and recommend changes based on these reviews. The program includes guidance to assist the system engineers in achieving efficient and effective trending.

(6) Acceptance Criteria:

Periodic Surveillance and Preventive Maintenance Program acceptance criteria are defined in the specific inspection and testing procedures. They confirm component integrity by verifying the absence of the aging effect or by comparing applicable parameters to limits based on the applicable intended function(s) as established by the plant design basis.

(7) Corrective Actions:

Identified deviations are evaluated within the FCS corrective action process, which includes provisions for root cause determinations and corrective actions to prevent recurrence as dictated by the significance of the deviation. The FCS corrective action process is in accordance with 10 CFR 50 Appendix B.

(8) Confirmation Process:

The FCS corrective action process is in accordance with 10 CFR 50 Appendix B and includes:

- Reviews to assure that proposed actions are adequate;
- Tracking and reporting of open corrective actions; and
- For root cause determinations, reviews of corrective action effectiveness.

(9) Administrative Controls:

All credited aging management activities are subject to the FCS administrative controls process, which is in accordance with 10 CFR 50 Appendix B and requires formal reviews and approvals.

(10) Operating Experience:

Periodic surveillance and preventive maintenance activities have been in place at FCS since the plant began operation. These activities have a demonstrated history of detecting damaged and degraded components and causing their repair or replacement in accordance with the site corrective action process. With few exceptions, age-related degradation adverse to component intended functions was discovered and corrective actions were taken prior to loss of intended function.

Conclusion:

The Periodic Surveillance and Preventive Maintenance Program assures that various aging effects are managed for a wide range of components at FCS. Based on the program structure and administrative processes and FCS operating experience, there is reasonable assurance that the credited inspection and testing activities of the Periodic Surveillance and Preventive Maintenance Program will continue to adequately manage the identified aging effects of the applicable components so that the intended functions will be maintained consistent with the current licensing basis for the period of extended operation.

The staff reviewed the applicant's response to Open Item 3.6.2.4.3.2-1, including the revised aging management program description, and finds that the applicant has provided an acceptable aging management program to manage the aging effects associated with the bus bars/ducts. On this basis, Open Item 3.6.2.4.3.2-1 is closed.

The staff also reviewed the revised USAR Supplement for the AMP and concludes that it provides an adequate description of the program, as required by 10 CFR 54.21(d).

3.6.2.4.3.3 Conclusions

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects for the bus bars and will have adequate AMPs and TLAAs for managing the aging effects for bus bars, such that the component 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 concludes that the USAR Supplement provides an adequate program description of the AMPs credited for managing aging in bus bars to satisfy 10 CFR 54.21(d).

3.6.2.4.4 Aging Management of SBO Components

3.6.2.4.4.1 Summary of Technical Information in the Application

The staff found that the screening results in Section 2.5 did not include any offsite power system structures or components related to the recovery of offsite power from an SBO event. 10 CFR 54.4(a)(3) requires that, "all systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission regulation for SBO (10 CFR 50.63) be included within the scope of license renewal." The function of the offsite power system with the SBO rule is, therefore, to provide a means of recovering from the SBO. This meets the criteria within license renewal 10 CFR 54.4(a)(3) as a system that performs a function that demonstrates compliance with the Commission's regulations on SBO. 10 CFR 54.4(a)(3) also requires that applicable offsite power system structures and components required for compliance with the SBO rule should be included within the scope of license renewal and subject to an AMR, or additional justification for their exclusion should be provided.

3.6.2.4.4.2 Staff Evaluation

In a letter dated October 11, 2002, the staff issued RAI 2.5-1 regarding the scoping and screening of SSCs which are required to comply with the SBO rule. Specifically, the staff requested the applicant to clarify why switchyard systems were not relied upon in safety analyses to perform a function in the recovery from SBO. The applicant responded to RAI 2.5-1 by letter dated December 19, 2002, stating that it will revise the license renewal documentation to comply with the NRC ISG-02 on SBO.

The applicant identified the following passive, long-lived electrical components comprising the offsite power system that are within the scope of license renewal and subject to an AMR:

- high voltage bus work/duct
- aluminum conductor, steel reinforced (ACSR) transmission cables
- insulators associated with the transmission conductors
- transmission towers and supports
- non-EQ cables (4 kV and 600 V)
- 125 volt (120 Vac)control cables

The staff reviewed the applicant's AMR results for the electrical components for SBO restoration system components that were provided in response to RAI 2.5-1. The applicant's AMR results for the electrical components for external environment are shown in Table 2 of the applicant's response to RAI 2.5-1. This table also refers to plant-specific programs that have been credited for aging management of the SBO restoration system components. However, several SBO components (high voltage bus work/duct, ACSR transmission cables and insulators associated with the transmission conductors) are not identified in this table as requiring an AMR. Therefore, it was not clear to the staff whether these components are within the scope of license renewal and subject to an AMR. By letter dated February 20, 2003, the staff issued POI-6(a) requesting the applicant to clarify whether these components are within scope and subject to an AMR.

By letter dated March 14, 2003, the applicant responded to POI-6(a) by providing the requested information. The applicant has also provided the associated aging management information to allow the staff to determine whether the components will be adequately managed during the period of extended operation. Specifically, the applicant responded to POI-6(a) by stating that:

> The high-voltage aluminum conductor is steel reinforced (ACSR) transmission cable and is considered within the scope of license renewal for SBO. In accordance with EPRI TR-114882, "Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools," Rev. 2, 1999, no aging effects were identified for aluminum, aluminum alloys, copper, or copper alloys (brass, bronze) in an indoor or outdoor air environment. Transmission conductor vibration would be caused by wind loading. Wind loading that can cause a transmission line and insulators to vibrate is considered in the design installation. Loss of material (wear) and fatigue that could be caused by transmission conductor vibration or sway are not aging effects requiring management of the period of extended operation at FCS. A review of internal and external operating experience has not identified any aging effects requiring management.
>
> The insulators associated with the transmission conductors are made of porcelain and are within the scope of license renewal. Aging effects that are considered are buildup of surface contaminants and loss of material due to vibration (wear). As indicated above, (transmission line vibration), vibration due to wind loading is a design consideration and not considered an aging effect requiring management. Buildup of surface contaminants (i.e., dust, dirt, etc.) can occur, however, it is gradual and frequently washed away by rain, consequently the buildup of surface contaminants is not significant and therefore not an aging effect requiring management at Fort Calhoun. Information notices (INs) applicable to insulator contamination (IN 93-95) relate to a loss of power due to salt buildup. Fort Calhoun is not located in an area of any salt concentration (Nebraska) and, therefore does not consider this IN applicable. On the basis of the above, it has been determined that the porcelain insulators in outside air at Fort Calhoun are not subject to any aging effects requiring management.
>
> The arresters associated with the offsite power system, although within the SBO boundary, do not have any intended functions associated with license renewal, and are eliminated from the scope of license renewal as active components in accordance with NEI 95-10.
>
> The isolated phase bus duct (i.e., isophase or 22 KV bus duct) encloses bus work that connects the main generator output to the main transformer. It is not related to the underground bus duct that may carry low voltage power, control, and instrumentation wiring. The buswork has no AERM. The enclosures supports for the isophase bus are identified in the LRA and assigned to the structures monitoring program for external environment. There is no AERM for internal environment.
>
> The 125 volt dc and 120 volt ac control and instrumentation cables that are associated with breaker controls and instrumentation within the SBO Restoration System have been considered in the scope of License Renewal for SBO. Under non-EQ cables, all cables are subject to the non-EQ cable AMR. All non-EQ cable was identified in, and managed by, the non-EQ cable aging management program (B.3.4).

On the basis of the information provided in response to POI-6(a), the staff concludes that the applicant has provided the associated aging management information to allow the staff to determine whether the components will be adequately managed during the period of extended operation. However, the basis for the applicant's assertion that bus bars/ducts and high voltage ACSR transmission conductors have no aging effects is not clear to the staff. The staff discussed the issues with the applicant, requesting the applicant to clearly describe how the connection from both SBO recovery paths are made, and to discuss the connection path up to and beyond the main transformer.

Also, as discussed in Section 3.6.2.4.3.2 of this SER, the staff pointed out that industry experience has identified several problems with the bus bars/ducts. The staff's review of bus bars/ducts can be found in Section 3.6.2.4.1.2 of this SER. In addition, the aging effect for the transmission ACSR conductor is loss of conductor strength and vibration. The applicant has addressed the vibration and the aluminum portion of the conductor, but did not address the steel portion. The most prevalent mechanism contributing to loss of conductor strength is corrosion, which includes corrosion of steel core and aluminum strand pitting. The staff requested that the applicant provide a description of its aging management programs used to manage the aging effects in high voltage conductors, or provide justification for why such programs are not needed. This was identified as Open Item 3.6.2.4.4.2-1.

By letter dated July 7, 2003, the applicant explained that it had performed a thorough review of industry operating experience related to the aging effects on high-voltage components, including ACSR. A detailed discussion on surface contaminants was provided in response to POI-6a (LIC-03-0035, dated March 14, 2003). The portion of that discussion on surface contaminants also applies to ACSR steel core.

The aging effects identified for high-voltage insulators, transmission conductors, switchyard bus, and un-insulated ground conductors are not heat-related, so ohmic heating is not required to be addressed (the applicant referenced the License Renewal Electrical Handbook, Electronic Power Research Institute (EPRI) 1003057, Final Report, December 2001, page 12-2, Ohmic Heating for Power Applications).

For ACSR conductors, corrosion degradation begins as a loss of zinc from the galvanized steel core wires. Corrosion rates depend largely on air quality, which includes suspended particles, chemistry, SO_2 concentration in air, precipitation, fog chemistry, and meteorological conditions (the applicant referenced the EPRI License Renewal Electrical Handbook, pages 581 and 584). Corrosion of ACSR conductors is a very slow-acting aging effect that is even slower in rural areas which generally have less suspended particles and SO_2 concentrations in the air than urban areas. 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. As illustrated in EPRI License Renewal Electrical Handbook, Final Report 1003057, December 2001, page 13-6, there is an ample strength margin to maintain the transmission conductor intended function through the period of extended operation.

On the basis of the above, the applicant determined that corrosion on high- voltage conductors is not a significant aging mechanism at FCS, and loss of conductor strength is, therefore, not an aging effect requiring management. There are no applicable aging effects that could cause the loss of the intended function of the transmission conductors for the period of extended operation.

The staff reviewed the applicant's response to Open Item 3.6.2.4.4.2-1 and agrees that the information provided in the EPRI electrical handbook confirms that there is adequate margin to maintain the conductor function through the period of extended operation, and finds that the applicant has provided an acceptable justification for not providing aging management for the ACSR conductor. Open Item 3.6.2.4.4.2-1 is closed.

3.6.2.4.4.3 Conclusions

The staff reviewed Section 2.5 and 3.6 to determine whether the SCs subject to an AMR have been identified and adequately managed. On the basis of its review, the staff concludes that the applicant has identified the SCs that are subject to an AMR, and 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).

3.6.2.4.5 Fuse Holders

3.6.2.4.5.1 Summary of Technical Information in the Application

In LRA Section 2.5.1, “Cables and Connectors,” the applicant identifies fuse blocks as components within the scope of license renewal and subject to an AMR.

3.6.2.4.5.2 Staff Evaluation

In a letter dated May 16, 2002, the staff forwarded to the NEI and UCS, a proposed ISG (ISG-5) on screening of electrical fuse holders. The staff position indicated that fuse holders should be scoped, screened, and included in the AMR in the same manner as terminal blocks and other types of electrical connections that are currently being treated in the process. This position only applies to fuse holders that are not part of a larger assembly such as switchgear, power supplies, power inverters, battery chargers, circuit boards, etc. Fuse holders in these types of active components would be considered to be piece parts of the larger assembly and not subject to an AMR.

The intended functions of a fuse holder are to provide mechanical support for the fuse and to maintain electrical contact with the fuse blades or metal end caps to prevent the disruption of the current path during normal operating conditions when the circuit current is at or below the current rating of the fuse. Fuse holders perform the same primary function as connections of “providing electrical connections to specified sections of an electrical circuit to deliver rated voltage, current, or signals.” These intended functions of fuse holders meet the criteria of 10 CFR 54.4(a). In addition, these intended functions are performed without moving parts or without a change in configuration or properties as described in 10 CFR 54.21(a)(1)(I). The fuse holders into which fuses are placed are typically constructed of blocks of rigid insulating material, such as phenolic resins. Metallic clamps are attached to the blocks to hold each end of the fuse. The clamps can be spring loaded clips that allow the fuse ferrules or blades to slip in, or they can be bolt lugs to which the fuse ends are bolted. The clamps are typically made of copper.

Operating experience as discussed in NUREG-1760 (Aging Assessment of Safety-Related Fuses Used in Low- and Medium-Voltage Applications in Nuclear Power Plants) identified that aging stressors such as vibration, thermal cycling, electrical transients, mechanical stress, fatigue, corrosion, chemical contamination, or oxidation of the connection surfaces can result in fuse holder failure.

In LRA Section 2.5.1, “Cables and Connectors,” the applicant identified fuse blocks as components within the scope of license renewal and subject to an AMR. The staff was unsure whether fuse holders were included within the component type, “Fuse Block.” By letter dated February 20, 2003, the staff issued POI-1(c) requesting the applicant to clarify whether fuse holders are within the scope of license renewal and subject to an AMR, and, if fuse holders are brought into scope and require aging management, to provide the associated aging management information.

By letter dated March 14, 2003, the applicant provided the following requested information.

> Fuse holders are within the scope of license renewal as part of the cable and connector scoping and screening analysis. There are no fuse holders attached to electrical penetrations at FCS. Fuse holders at FCS that are within active enclosures such as power supplies, switchgear, and motor control centers are considered outside the scope for license renewal. There are no fuse holders at FCS exposed to vibration or environments that would cause corrosion, chemical contamination, or oxidation of the connecting surfaces. Fuse holders within enclosures that are not considered active

and subject to mechanical stress, fatigue and electrical transients will be included in the Fatigue-Monitoring Program(B.2.4).

The staff reviewed the applicant's response to POI-1(c) regarding whether fuse holders within the enclosures are considered active and whether they are subject to stress and fatigue. The staff discussed this issue with the applicant. The applicant believed that there are no fuse holders that would fall within the definition of being in an outside environment that would need aging management review, but was not sure. The staff was still unclear regarding the aging management of fuse holders. ISG-5, "Identification and Treatment of Electrical Fuse Holders," which discusses scoping, screening, and aging management of fuse holders, states that fuse holders inside the enclosure of an active component, such as switchgear, power supplies, power inverters, battery chargers, and circuit boards, are considered to be piece parts of the larger assembly, and thus are not subject to an AMR. The staff requested that the applicant make a positive statement that all fuse holders are within active enclosures and hence are not within scope and need not be subject to an AMR. If the applicant cannot make this statement, the staff requested that the applicant clarify how fuse holders within the scope of license renewal and subject to an AMR will be managed during the period of extended operation. This was identified as Open Item 3.6.2.4.5.2-1(a). The staff was also concerned that the applicant may have missed fuse holders which are used in circuits to isolate safety loads from non-safety loads. The staff requested that the applicant investigate and confirm whether any fuse holders fall into this category. This was identified as Open Item 3.6.2.4.5.2-1(b).

By letter dated July 7, 2003, the applicant clarified that fuse blocks (fuse holders) at FCS are either in active components (panels, switchgear, or cabinets), which are outside the scope of license renewal, or are in enclosures (junction boxes) that are in controlled environments. The applicant stated that it will manage the aging of fuse holders in accordance with ISG-5.

Further, the applicant clarified that FCS does not have any fuse holders in circuits used to isolate safety loads from non-safety loads that are in areas of environmental extremes or that are subject to aging management.

On the basis of the applicant's response to Open Item 3.6.2.4.5.2-1, the staff concludes that the applicant has clarified which fuse holders are within scope and has clarified that management of fuse holders within the scope of license renewal and subject to an AMR will be done in accordance with ISG-5. The staff finds this acceptable. Finally, the applicant has clarified that there are no fuse holders that are used to isolate safety and non-safety loads that are subject to an AMR. The staff finds this acceptable. On this basis, Open Item 3.6.2.4.5.2-1 is closed.

The staff also reviewed the USAR Supplement for the fatigue monitoring program and concludes that it provides an adequate summary description of the program to satisfy 10 CFR 54.21(d).

3.6.2.4.5.3 Conclusions

On the basis of its review, the staff concludes that the applicant has adequately identified the aging effects, and the AMPs credited for managing the aging effects, for the fuse holders, such that the component 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 USAR Supplement program description and concludes that the USAR Supplement provides an adequate description of the AMP credited for managing aging in the fuse holders, as required by 10 CFR 54.21(d).

3.6.3 Evaluation Findings

The staff has reviewed the information in Sections 2.5 and 3.6 of the LRA. On the basis of its review, the staff concludes that the applicant has demonstrated that the aging effects associated with the identified components of the electrical and I&C systems will be adequately managed so that these components will perform their intended functions in accordance with the current licensing basis during the period of extended operation, as required by 10 CFR 54.21(a)(3). In addition, the staff also concludes that the USAR Supplements provide acceptable descriptions of the programs and activities for managing the effects of aging of the electrical and I&C system components for the period of extended operation, as required by 10 CFR 54.21(d).

SECTION 4

TIME-LIMITED AGING ANALYSES

Section 4 - Table of Contents

4 Time-Limited Aging Analyses

4.1 Identification of Time-Limited Aging Analyses

This section addresses the identification of time-limited aging analyses (TLAAs). The applicant discusses the TLAAs in license renewal application (LRA) Sections 4.2 through 4.7. The staff's review of the TLAAs can be found in Sections 4.2 through 4.7 of this safety evaluation report (SER).

The TLAAs are certain plant-specific safety analyses that are based on an explicitly assumed 40-year plant life. Pursuant to Section 54.21(c)(1) of Title 10 of the *Code of Federal Regulations* (10 CFR 54.21(c)(1)), the applicant for license renewal must provide a list of TLAAs, as defined in 10 CFR 54.3.

In addition, pursuant to 10 CFR 54.21(c)(2), an applicant must provide a list of plant-specific exemptions granted under 10 CFR 50.12 that are based on TLAAs. For any such exemptions, the applicant must provide an evaluation that justifies the continuation of the exemptions for the period of extended operation.

4.1.1 Summary of Technical Information in the Application

The applicant evaluated calculations for the Fort Calhoun Station, Unit 1 (FCS) against the six criteria specified in 10 CFR 54.3 to identify the TLAAs. The applicant indicated that calculations that meet the six criteria were identified by searching the current licensing basis (CLB), which includes the updated safety analysis report (USAR), design basis documents, the Statements of Consideration for 10 CFR Part 54, NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants, " dated July 2001 (SRP-LR), and Nuclear Energy Institute (NEI) 95-10. The applicant listed the following TLAAs in Table 4.1-1 of the LRA:

- reactor vessel neutron embrittlement; including analyses for upper shelf energy, pressurized thermal shock, low-temperature overpressure protection (LTOP) power operated relief valve (PORV) setpoints, and pressure-temperature limits
- metal fatigue; including analysis of ASME Section III Class 1 vessels, RCS piping, and Class II and III components
- environmental equipment qualification
- concrete containment prestress
- containment liner and penetration sleeve fatigue
- reactor coolant pump flywheel fatigue
- leak-before-break analysis
- high-energy line break

Pursuant to 10 CFR 54.21(c)(2), the applicant stated that no exemptions granted under 10 CFR 50.12 that were based on a TLAA, as defined in 10 CFR 54.3, were identified.

4.1.2 Staff Evaluation

In LRA Section 4.1, the applicant identified the TLAAs applicable to FCS and discussed exemptions based on TLAAs. The staff reviewed the information to determine whether the applicant provided adequate information to meet the requirements of 10 CFR 54.21(c)(1) and 10 CFR 54.21(c)(2).

TLAAs are defined in 10 CFR 54.3 as analyses that meet the following six criteria:

- involve systems, structures, and components within the scope of license renewal, as delineated in Section 54.4(a)
- consider the effects of aging
- involve time-limited assumptions defined by the current operating term, for example, 40 years
- were determined to be relevant by the applicant in making a safety determination
- involve conclusions, or provide the basis for conclusions, related to the capability of the system, structure, and component to perform its intended functions, as delineated in Section 54.4(b)
- are contained or incorporated by reference in the CLB

The applicant listed the TLAAs applicable to FCS in Table 4.1-1 of the LRA. Tables 4.1-2 and 4.1-3 in the SRP-LR identify potential TLAAs determined from the review of other license renewal applications. In RAI 4.1-1, the staff requested that the applicant discuss whether there are any calculations or analyses at FCS that address the topics listed in Tables 4.1-2 and 4.1-3 of the SRP-LR and were not included in Table 4.1-1 of the LRA.

In its RAI response dated December 12, 2002, the applicant indicated that documentation existed for two topics listed in the SRP-LR that were not identified as TLAAs at FCS. The first topic is metal corrosion allowance. The applicant indicated that corrosion allowances were made consistent with the requirements of the design codes; however, there are no discrete analyses related to metal corrosion allowances meeting the criteria of 10 CFR 54.3(a). The staff concludes that, because the applicant found no analyses related to metal corrosion allowances that meet the TLAA criteria, the applicant's response regarding the corrosion allowance is acceptable.

The second topic is the polar crane fatigue analysis. The applicant indicated that the crane was purchased using a specification based on Electric Overhead Crane Institute Standard (EOCI)-61, which does not address fatigue failure. The applicant indicated that it also reviewed the polar crane against the fatigue criteria of American Society of Mechanical Engineers (ASME) NOG-1 and Crane Manufacturers Association of America (CMAA)-70 and concluded that the number of anticipated cycles is well below the limits which would require fatigue analyses in accordance with NOG-1 and CMAA-70. The applicant's assessment is consistent with assessments performed by other license renewal applicants. The staff considers that the polar crane evaluation meets the definition of a TLAA in accordance with the criteria of 10 CFR 54.3(a). However, the staff agrees that the number of anticipated cycles will be well below the limits which would require fatigue analyses. On this basis, the staff finds that the applicant's evaluation of the polar crane, as discussed above, is acceptable and therefore the crane need not be evaluated as a TLAA.

Following the issuance of the SER with open items, the staff identified an additional TLAA regarding a repair of a temperature nozzle in the pressurizer lower shell. The staff informed the applicant of this additional TLAA, and the associated Open Item 4.7.4-1, by letter dated May 15, 2003. By letter dated July 7, 2003, the applicant responded to the open item. A summary of the open item and it's resolution is provided in Section 4.7.4 of this SER.

10 CFR 54.21(c)(2) requires an applicant to provide a list of all exemptions granted under 10 CFR 50.12 which are determined to be based on a TLAA, and an evaluation and justification for continuation through the period of extended operation. In the LRA, the applicant stated that it performed a search of the FCS electronic docket and each exemption was reviewed for TLAA applicability. No TLAA-based exemptions were identified. On the basis of the information provided by the applicant with regard to the process used to identify TLAA-based exemptions, and the results of the applicant's search, the staff finds that the applicant has found no TLAA-based exemptions which would require justification for continuation through the period of extended operation to satisfy 10 CFR 54.21(c)(2)

4.1.3 Conclusions

On the basis of its review, including its identification of the additional TLAA discussed in Section 4.7.4 of this SER, the staff concludes that all TLAAs have been identified for FCS, as required by 10 CFR 54.21(c)(1), and has confirmed that no 10 CFR 50.12 exemptions have been granted on the basis of a TLAA, as required by 10 CFR 54.21(c)(2).

4.2 Reactor Vessel Neutron Embrittlement

The applicant has identified four analyses affected by irradiation embrittlement that have been identified as TLAAs. These analyses are discussed in Sections 4.2.1 through 4.2.4 of the LRA. The analyses identified as TLAAs are:

- pressure/temperature (P/T) curves
- low-temperature overpressure protection (LTOP) power-operated relief valve (PORV) setpoints
- pressurized thermal shock (PTS)
- reactor vessel upper shelf energy

Neutron embrittlement is a significant aging mechanism for all ferritic materials that have a neutron fluence of greater than 10^{17} n/cm^2 (E>1 MeV) at the end of the period of extended operation. The relevant calculations use predictions of the cumulative damage to the reactor vessel from neutron embrittlement and were originally based on the 40-year expected life of the plant. The reactor pressure vessel contains the core fuel assemblies and is made of thick steel plates that are welded together. Neutrons from the fuel in the reactor irradiate the vessel as the reactor is operated and change the material properties of the steel. The most pronounced and significant changes occur in the material property known as fracture toughness. Fracture toughness is a measure of the resistance to crack extension in response to stresses. A reduction in this material property due to irradiation is referred to as embrittlement. The largest amount of embrittlement usually occurs at the section of the vessel's wall closest to the reactor fuel referred to as the vessel's beltline. FCS uses a "low leakage" PWR core design that reduces the number of neutrons that reach the vessel wall and thus limits the vessel's embrittlement. However, the rate at which the vessel's steel embrittles also depends on its chemical composition. The amounts of two elements in the steel, copper and nickel, are the most important chemical components in determining how sensitive the steel is to neutron irradiation.

4.2.1 Plant Heatup/Cooldown (P/T) Curves and LTOP PORV Setpoints

4.2.1.1 Summary of Technical Information in the Application

The current P/T analyses are valid out to 40 effective full power years (EFPY), which extends beyond the current operating license period but not to the end of the period of extended operation. LTOP limits are considered as part of the calculation of P/T curves. The technical specifications will continue to be updated as required by either Appendix G or H of 10 CFR Part 50, or as operational needs dictate. This will assure that operational limits remain valid for current and projected cumulative neutron fluence levels.

4.2.1.2 Staff Evaluation

In response to RAI 4.2-1, the applicant indicated that the NRC has approved the revised limits and issued Technical Specification Amendment 207 for FCS. Using the methodology approved with the issuance of Technical Specification Amendment 207, the applicant has projected the P/T and LTOP limits to the end of the period of extended operation and determined that the reactor pressure vessel can be operated with the projected P/T and LTOP limits. The technical specifications will continue to be updated as required by either Appendix G or H of 10 CFR Part 50, or as operational needs dictate. This will assure that operational limits remain valid for current and projected cumulative neutron fluence levels. Since the technical specifications will continue to be updated as required by either Appendix G or H of 10 CFR Part 50, additional analysis at this time is not required. On this basis, the staff concludes that the applicant has a process for updating the plant heatup/cooldown (P/T) curves and LTOP PORV setpoints at FCS for the period of extended operation, which satisfies 10 CFR 54.21(c)(1)(iii) and Appendices G and H of 10 CFR Part 50.

The staff also reviewed the USAR Supplement for this TLAA and concludes that it provides an adequate summary description of the TLAA to satisfy 10 CFR 54.21(d).

4.2.2 Pressurized Thermal Shock

10 CFR 50.61 provides the fracture toughness requirements protecting the reactor vessels (RVs) of PWRs against the consequences of pressurized thermal shock (PTS). Licensees are required to perform an assessment of the reactor vessel materials' projected values of the PTS reference temperature, RT_{PTS}, through the end of their operating license. The rule requires each licensee to calculate the end-of-life RT_{PTS} value for each material located within the beltline of the reactor pressure vessel. The RT_{PTS} value for each beltline material is the sum of the unirradiated nil ductility reference temperature (RT_{NDT}) value, a shift in the RT_{NDT} value caused by exposure to high-energy neutron irradiation of the material (i.e., ΔRT_{NDT} value), and an additional margin value to account for uncertainties (i.e., M value). 10 CFR 50.61 also provides screening criteria against which the calculated RT_{PTS} values are to be evaluated. For reactor vessel beltline base-metal materials (forging or plate materials) and longitudinal (axial) weld materials, the materials are considered to provide adequate protection against PTS events if the calculated RT_{PTS} values are less than or equal to 270 °F. For reactor vessel beltline

circumferential weld materials, the materials are considered to provide adequate protection against PTS events if the calculated RT_{PTS} values are less than or equal to 300 °F. Regulatory Guide (RG) 1.99, Revision 2, “Radiation Embrittlement of Reactor Vessel Materials,” provides an expanded discussion regarding the calculations of the shift in the RT_{NDT} value caused by exposure to high-energy neutron irradiation and the margin value to account for uncertainties. In RG 1.99, the shift in the RT_{NDT} value caused by exposure to high-energy neutron irradiation is the product of a chemistry factor and a fluence factor. The fluence factor is dependent upon the neutron fluence, and the chemistry factor may be determined from surveillance material or from the tables in RG 1.99. If the reactor vessel beltline material is not represented by surveillance material, its chemistry factor and the shift in the RT_{NDT} value caused by exposure to high-energy neutron irradiation may be determined using the methodology documented in Position 1.1 and the tables in RG 1.99. The chemistry factor determined from the tables in RG 1.99 depends upon the amount of copper and nickel in the beltline. If the reactor vessel beltline material is represented by surveillance material, its chemistry factor may be determined from the surveillance data using the methodology documented in Position 2.1 of RG 1.99.

4.2.2.1 Summary of Technical Information in the Application

The applicant indicates that it has completed the projected RT_{PTS} calculation, and the NRC has concluded that RT_{PTS} values for the FCS reactor vessel beltline materials will remain below the 10 CFR 50.61 PTS screening criteria until 2033, the end of the period of extended operation. Therefore, the analyses have been projected to the end of the period of extended operation.

4.2.2.2 Staff Evaluation

In a license amendment dated August 3, 2000, and letters dated November 17, 2000, and February 14, 2001, the applicant provided RT_{PTS} analyses for the materials in the FCS reactor vessel. The August 3, 2000, license amendment contains report CEN-636, “Evaluation of Reactor Vessel Surveillance Data Pertinent to the Fort Calhoun Reactor Vessel Beltline Materials.” Table 10 in CEN-636, Revision 2, provides the chemistry factor and the predicted RT_{PTS} value through 2033 for each plate and weld in the FCS reactor vessel beltline. Many of the materials’ RT_{PTS} values are dependent upon surveillance data, which could affect their RT_{PTS} value.

In response to RAI B.1.7-1, the applicant provided for each beltline material the projected neutron fluence at the end of the period of extended operation and the neutron flux assumed for future core loadings. The fluence values were obtained from WCAP-15443, Revision 0, which was reviewed and approved by the NRC for Technical Specification Amendments 197 and 199. The overall exposure evaluation methodology is based on guidance provided in Draft Regulatory Guide DG-1053 and makes use of the latest ENDF/B-VI neutron transport and dosimetry cross-sections included in the BUGLE-93 library. This fluence report also describes how the fluence was calculated and includes the benchmark of the fluence model and the azimuthal distribution for fluence across the reactor vessel. The fluence values for each material conservatively correspond to the end of fuel Cycle 41 (September 2033). The staff has reviewed the methodology documented in WCAP-15443 and endorses its use for calculating the neutron fluence to be used in the PTS and the reactor vessel upper shelf energy analyses.

In response to RAI B.1.7-1, the applicant also explained how the reactor vessel integrity program (RVIP) will monitor future core loadings to ensure that no beltline material will exceed the PTS screening criteria in 10 CFR 50.61. The applicant indicates that compliance with 10 CFR 50.61 is monitored as part of the program basis document for the RVIP. This program is administered by the FCS Design Engineering-Nuclear Engineering Department. The Nuclear Engineering Department also performs core reload analyses in-house, including core design. During core loading development, core patterns are quantitatively evaluated to ensure that neutron flux to the limiting 3-410 welds is maintained approximately the same as that of Cycle 15, which formed the basis of the fluence analysis. This is done by summing the peripheral fuel assembly relative power densities multiplied by weighting factors derived from the fluence analysis adjoint flux solution. Thus, values from a new fuel cycle can be compared to that of Cycle 15 to determine if there has been a net increase or decrease, with a goal of having a time average value the same as Cycle 15. Periodic updates of the fluence analysis are planned. RT_{PTS} is also tracked on an ongoing basis.

According to 10 CFR 50.61(b), “Requirements,” each licensee is required to update its PTS assessment whenever there is a significant change in the projected value of RT_{PTS}. Therefore, if the applicant’s core loading pattern should deviate from that assumed in the PTS analysis, the applicant would be required to provide the staff with an updated assessment.

Using the neutron fluences contained in RAI B.1.7-1 and the chemical composition data and surveillance data reported in CEN-636, Revision 2, the staff calculated the predicted RT_{PTS} through 2033. The results of the staff’s analysis are documented in Table 4.2.2 below. In the staff’s analysis, weld 3-410 A/C, which was fabricated using tandem electrodes with weld wire heat numbers 12008 and 13253, was projected to be closest to the PTS screening (1 ^{o}F below the PTS screening criteria) at the expiration of extended operation in 2033. Surveillance data were used in the analysis to determine the chemistry factor for plate heat number A1768-1 and welds fabricated using weld wire heat numbers 12008, 13253, and 27204. All other beltline materials did not have surveillance material. Therefore, the chemistry factors were determined using the tables in RG 1.99. On the basis of its evaluation, the staff confirmed that all beltline materials will be below the PTS screening criterion at the expiration of extended operation in 2033 to satisfy 10 CFR 54.21(c)(1)(ii).

On this basis, the staff concludes that the applicant has adequately evaluated PTS at FCS for the period of extended operation by projecting the PTS analyses to the end of the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii).

The staff also reviewed the USAR Supplement for this TLAA and concludes that it provides an adequate summary description of the TLAA to satisfy 10 CFR 54.21(d).

Table 4.2.2

Plate or Weld Identification	Plate Heat No. or Weld Heat No.	PTS Screening Criteria (°F)	Method of Predicting Chemistry Factor	Predicted RT_{PTS} through 2033 (°F)
Plate D4802-1	C2585-3	270	Table	143
Plate D4802-2	A1768-1	270	Surveillance	131
Plate D4802-3	A1768-2	270	Table	131
Plate D4812-1	C3213-2	270	Table	144
Plate D4812-2	C3143-2	270	Table	120
Plate D4812-3	C3143-3	270	Table	120
Weld 2-410 A/C	51989	270	Table	120
Weld 3-410 A/C	12008/13253(T)[1]	270	Table	269
Weld 3-410 A/C	13253 (T)[1]	270	Surveillance	225
Weld 3-410 A/C	12008/27204 (T)[1]	270	Surveillance	245
Weld 3-410 A/C	27204 (T)[1]	270	Surveillance	256
Weld 9-410	20291	300	Table	260

[1] T indicates welds were fabricated using weld wires in tandem

4.2.3 Reactor Vessel Upper Shelf Energy

The NRC regulations that provide screening criteria for the upper shelf energy (USE) are in 10 CFR Part 50, Appendix G. Appendix G requires that reactor vessel beltline materials have Charpy USE values in the transverse direction for the base metal and along the weld for the weld material, according to the ASME Code, of no less than 75 ft-lb (102 J) initially, and must maintain Charpy USE values throughout the life of the vessel of no less than 50 ft-lb (68 J). However, Charpy USE values below these criteria may be acceptable if it is demonstrated in a manner approved by the Director, Office of Nuclear Reactor Regulation, that the lower values of Charpy USE will provide margins of safety against fracture equivalent to those required by Appendix G of Section XI of the ASME Code. RG 1.99 provides an expanded discussion regarding the calculations of Charpy USE values and describes two methods for determining Charpy USE values for reactor vessel beltline materials, depending on whether a given reactor vessel beltline material is represented in the plant's reactor vessel material surveillance program (i.e., 10 CFR Part 50, Appendix H program). If surveillance data are not available, the Charpy USE is determined in accordance with Position 1.2 in RG 1.99. If two or more credible surveillance data (as defined in Section B, "Discussion," of RG 1.99) are available, the Charpy

[1] T indicates welds were fabricated using weld wires in tandem

USE should be determined in accordance with Position 2.2 in RG 1.99. These methods refer to Figure 2 in RG 1.99, which indicates that the percentage drop in Charpy USE is dependent upon the amounts of copper and the neutron fluence. Since the analyses performed in accordance with Appendix G to 10 CFR Part 50 are based on a flaw with a depth 1/4 through wall, the neutron fluence used in the Charpy USE analysis is the neutron fluence at the 1/4T (thickness) depth location.

4.2.3.1 Summary of Technical Information In the Application

The applicant indicates that preliminary calculations have shown that the vessel beltline Charpy USE for the limiting weld will be approximately 54.6 ft-lbs based on Position 1.2 of RG 1.99. This value remains above the regulatory approved minimum of 50 ft-lbs through the period of extended operation. The existing Appendix G analysis will be finalized and formally revised to reflect that it bounds the minimum approved fluence value at the end of plant life. However, the analyses had not been projected to the end of the period of extended operation at the time that the LRA was submitted for staff review.

4.2.3.2 Staff Evaluation

In response to RAI 4.2-2, the staff requested that the applicant provide for each beltline material (a) the projected peak neutron fluence at a depth of 1/4T at the end of the period of the extended operation, (b) the unirradiated Charpy USE, (c) the amount of copper, (d) the Charpy USE at the end of the period of extended operation, (e) the method of determining the decrease in Charpy USE at the end of the period of extended operation, and (f) the impact of surveillance data on the Charpy USE analysis. The applicant did not provide the impact of surveillance data representing welds fabricated using tandem electrodes with weld wire heat number 13253 and welds fabricated using tandem electrodes with wire heat number 27204. The applicant must provide all the surveillance data applicable to its plant and must determine the impact of all the surveillance data on the Charpy USE analysis. By letter dated February 20, 2003, the staff issued POI-13(a) requesting this information. By letter dated March 14, 2003, the applicant provided the requested information.

In response to this POI, the applicant performed a revised analysis and documented the results of its analysis in Table A.3.1.4-1,"Fort Calhoun Station Upper Shelf Energy Data for Operation to 48 EFPY." In this analysis, the Charpy USE for each reactor vessel beltline material was determined in accordance with position 1.2 of RG 1.99. The lowest predicted Charpy USE at 48 EFPY was 54.6 ft-lb. Position 1.2 states that the percent drop of Charpy USE is a function of the percent copper and neutron fluence, as indicated in Figure 2 of RG 1.99. The applicant has determined the percent drop of Charpy USE for each weld wire heat used in the FCS beltline weld based on: (a) the best-estimate copper for each heat of weld wire; (b) the projected neutron fluence at the 1/4-T depth location at 48 EFPY; and (c) Figure 2 of RG 1.99. The projected Charpy USE at the 48 EFPY is the difference between the unirradiated Charpy USE and the percent drop in Charpy USE. The staff has performed an independent evaluation in accordance with the methodology in RG 1.99 and confirmed the projected Charpy USE values at 48 EFPY for the FCS reactor vessel beltline materials.

In addition, the applicant provided in Table 4.2-2-2 the results of its analysis of irradiated Charpy USE surveillance weld data from other plants that have surveillance data that is applicable to the FCS reactor vessel beltline welds. The data was from surveillance capsules from DC Cook Unit 1, Diablo Canyon Unit 1, Salem Unit 2, and Mihama Unit 1. The surveillance welds for DC Cook Unit 1 and Salem Unit 2 were fabricated using the same weld wire heat number (heat number 13253) as used in the FCS reactor vessel beltline Weld Number 3-410. Weld Number 3-410 also utilized weld wire from heat numbers 27204 and 12008/27204. The Diablo Canyon Unit 1 surveillance weld was fabricated from weld wire heat number 27204 and the Mihama Unit 1 surveillance weld was fabricated using tandem weld wires from heat numbers 12008 and 27204. FCS weld Number 3-410 was projected to have a neutron fluence at 1/4T depth at 48 EFPY of 1.62×10^{19} n/cm^2. The applicant indicated that the capsule with the highest neutron fluence was from the third Mihama Unit 1 surveillance capsule with a neutron fluence of 2.1×10^{19} n/cm^2. The surveillance weld samples from the third Mihama surveillance capsule demonstrated a Charpy USE value of 61 ft-lb. Surveillance weld samples from all other applicable capsules demonstrated higher Charpy USE values. The applicant concluded that the projected values of Charpy USE for the FCS beltline welds, ranging from 54.6 to 66 ft-lb, are consistent with the values of Charpy USE measured for the surveillance materials from Diablo Canyon, Mihama, DC Cook, and Salem.

The staff has performed an independent analysis of the surveillance data from DC Cook Unit 1, Diablo Canyon Unit 1, Salem Unit 2, and Mihama Unit 1 to determine whether the methodology described in position 1.2 of RG 1.99 is conservative for the weld wires used in fabricating the FCS reactor vessel beltline. Figure 2 of RG 1.99 describes the relationship between neutron fluence and percent drop in Charpy USE as linear on a log-log scale for a specified amount of copper. Hence, the change in Charpy USE with neutron fluence for each beltline heat of weld wire would be described as a line on the log-log plot in Figure 2 and determined by the copper content of each weld wire heat. The staff compared the surveillance data from DC Cook Unit 1, Diablo Canyon Unit 1, Salem Unit 2, and Mihama Unit 1 with the values for the corresponding line on the log-log plot in Figure 2 for the weld wires used in the beltline welds. All of the surveillance data, except for the Salem 2 and DC Cook Unit 1 data, were on or below the lines on the log-log plot in Figure 2 for the corresponding weld wire heats. For the Diablo Canyon Unit 1 and Mihama Unit 1 surveillance data, where the surveillance data is on or below the lines on the log-log plot in Figure 2 for the corresponding beltline heat of weld wire, the surveillance data indicates that the methodology represented by Figure 2 and position 1.2 of RG 1.99 is conservative and the values of Charpy USE determined using this methodology are acceptable. Since surveillance data from Salem Unit 2 and DC Cook Unit 1 exceeded the line representing the FCS weld wire heat 13253, the position 1.2 methodology would be non-conservative for this heat of weld wire. The staff determined the impact of this data using the methodology specified in position 2.2 of RG 1.99. Position 2.2 specifies that the percent drop in Charpy USE may be obtained by plotting the surveillance data on Figure 2 of the RG and fitting the data with a line drawn parallel to the existing lines as the upper bound of all the data. Using this methodology, the projected Charpy USE for heat number 13253 weld wire would be reduced from 66 ft-lb to 61.6 ft-lb at 48 EFPY. Since this value was determined in accordance with position 2.2 of RG 1.99, and is greater than 50 ft-lb, the welds in FCS that were fabricated using weld wire heat 13253 will have Charpy USE greater than 50 ft-lb at 48 EFPY.

FCS has surveillance weld metal and plate material being irradiated within its reactor vessel. The weld metal was prepared using a weld wire heat number that was not used in the FCS reactor vessel beltline; therefore, it does not represent any FCS reactor vessel beltline weld. The surveillance plate material was removed from beltline plate D4802-2, heat number A1768-1. Therefore, the decrease in Charpy USE observed on this surveillance plate would be representative of the decrease in Charpy USE that would be expected for the FCS beltline plate. Using the position 2.2 methodology in RG 1.99, the staff determined that the Charpy USE plate surveillance data would result in a Charpy USE at 48 EFPY for plate D4802-2 of 84 ft-lb. Position 2.2 was used for the evaluation of the plate, because the surveillance plate was removed from the beltline plate and they have equivalent chemical compositions.

Based on the staff and applicant evaluation of surveillance data and using the methodology from RG 1.99, all FCS reactor vessel beltline materials are projected to have Charpy USE at 48 EFPY greater than 50 ft-lb and will meet the screening criteria for Charpy USE in Appendix G, 10 CFR Part 50 at the expiration of the extended license. This completes the staff evaluation of Reactor Vessel USE and resolves POI-13(a).

The USAR Supplement did not contain the Charpy USE analysis that was performed in response to RAI 4.2-2. Since this analysis applies through the end of the period of extended operation, the applicant must revise the USAR Supplement to include the results of the Charpy USE performed in response to RAI 4.2-2. By letter dated February 20, 2003, the staff issued POI-13(b) requesting the applicant to revise the USAR Supplement. By letter dated March 14, 2003, the applicant provided a revised USAR Supplement Section A.3.1.4, which incorporated the results of the Charpy USE analysis. The staff reviewed the revised USAR Supplement and finds that it is an adequate description of the Charpy USE TLAA. POI-13(b) is resolved.

On this basis, the staff concludes that the applicant has adequately evaluated the RV USE at FCS for the period of extended operation by projecting the analysis to the end of the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii).

The staff also reviewed the USAR Supplement for this TLAA and concludes that it provides an adequate summary description of the TLAA to satisfy 10 CFR 54.21(d).

4.2.4 Conclusions

The staff has reviewed the TLAAs regarding the maintenance of acceptable Charpy USE levels for the FCS RV materials and the ability of the FCS RV to resist failure during postulated PTS events. On the basis of this evaluation, the staff concludes that the applicant’s TLAAs for Charpy USE and PTS meet the respective requirements of 10 CFR Part 50, Appendix G, and 10 CFR 50.61, for the FCS RV beltline materials, as evaluated to the end of the period of extended operation, and therefore satisfy the requirements of 10 CFR 54.21(c)(1)(ii) for 60 years of operation.

The staff will evaluate the P/T limit curves and the LTOP PORV setpoints, as described in LRA Section A.3.1.1, for the period of extended operation upon submittal by the applicant. The staff’s review of the P/T limit curves, when submitted, will ensure that the operation of the RCS for FCS will be done in a manner that ensures the integrity of the RCS during the period of extended operation and that the curves, when submitted, will satisfy the requirements of 10 CFR 54.21(c)(1)(ii) for the period of extended operation.

The staff has also reviewed the USAR Supplements for the P/T curves, LTOP PORV setpoints, PTS, and reactor vessel USE TLAAs, and finds that they provide adequate descriptions of the TLAAs, as required by 10 CFR 54.21(d).

4.3 Metal Fatigue

A metal component subjected to cyclic loading at loads less than the static design load may fail due to fatigue. Metal fatigue of components may have been evaluated based on an assumed number of transients or cycles for the current operating term. The validity of such metal fatigue analysis is reviewed for the period of extended operation.

4.3.1 Summary of Technical Information in the Application

The applicant discussed the design requirements for components of the RCS at FCS. The RV and major RCS components were designed to the ASME Boiler and Pressure Vessel Code, Section III requirements for Class A components. The reactor coolant loop piping and fittings were designed and fabricated in accordance with the requirements of United States of America Standard (USAS) B31.1, "Power Piping Code." The reactor coolant loop attached piping was designed and fabricated in accordance with the requirements of USAS B31.7, "Draft Code for Nuclear Power Piping." The fatigue analyses of both the reactor coolant loop and attached piping were performed in accordance with USAS B31.7.

The applicant listed the transients used in the design of RCS components in Section 4.3.1 of the LRA. The applicant indicated that it does not expect the number of design cycles for the transients that are counted to be exceeded during the period of extended operation. The applicant uses the fatigue monitoring program (FMP) to verify its conclusion. The FMP is discussed in Section B.2.4 of the LRA and evaluated in Section 3.0.3.8 of this SER. The applicant described the actions taken to address the issue of environmentally-assisted fatigue in Section 4.3.2 of the LRA.

The applicant describes its evaluation of the following fatigue-sensitive component locations:

- reactor vessel shell and lower head
- reactor vessel inlet and outlet nozzles
- pressurizer surge line elbow
- charging system nozzle
- safety injection system nozzle
- shutdown cooling system Class 1 piping

The applicant indicated that the evaluation found all locations were acceptable for the period of extended operation, with the exception of the pressurizer surge line. The applicant indicated that the pressurizer surge line will require further evaluation prior to the period of extended operation.

The applicant discussed the further evaluation of the pressurizer surge line in Section 4.3.3 of the LRA. The applicant indicated that the pressurizer surge line bounding locations will be included in the FMP. The applicant further indicated that actual operating data will be used to perform a reevaluation of the surge line prior to the period of extended operation.

The applicant discussed the evaluation of Class II and III components in Section 4.3.4 of the LRA. These components were designed to the requirements of USAS B31.1. USAS B31.1 specifies that a stress reduction factor be applied to the allowable thermal bending stress range if the number of full range cycles exceeds 7000. The applicant indicated that most piping systems within the scope of license renewal are only subject to occasional cyclic operation, and consequently, the analyses will remain valid during the period of extended operation. However, the applicant did indicate that the RCS hot leg sample line could exceed the 7000 cyclic limit during the period of extended operation and that it would be included in the FMP.

4.3.2 Staff Evaluation

As discussed in the previous section, components of the RCS at FCS were designed to the Class 1 requirements of the ASME Code, and the RCS piping was evaluated using the fatigue requirements of USAS B31.7. These requirements contain explicit criteria for the fatigue analysis of components. Consequently, the applicant identified the fatigue analysis of these components as TLAAs. The staff reviewed the applicant's evaluation of the RCS components for compliance with the provisions of 10 CFR 54.21(c)(1).

The specific design criterion for fatigue analysis of RCS components involves calculating the cumulative usage factor (CUF). The fatigue damage in the component caused by each thermal or pressure transient depends on the magnitude of the stresses caused by the transient. The CUF sums the fatigue damage resulting from each transient. The design criterion requires that the CUF not exceed 1.0. The applicant indicated that review of the FCS plant operating histories indicates that the number of cycles and severity of the transients assumed in the design of these components envelops the expected transients during the period of extended operation. In RAI 4.3-1, the staff requested that the applicant provide the following information for each of the transients described in Section 4.3.1 of the LRA:

- the current number of operating cycles and a description of the method used to determine the number of the design transients from the plant operating history

- the number of operating cycles estimated for 60 years of plant operation and a description of the method used to estimate the number of cycles at 60 years

- a comparison of the design transients listed in the LRA with the transients monitored by the FMP described in Section B.2.4 of the LRA; identification of any transients listed in the LRA that are not monitored by the FMP and an explanation of why it is not necessary to monitor these transients

The applicant's December 19, 2002, response provided a table which lists the current cycle counts for the design transients. The applicant indicated that these cycles were recorded in accordance with plant Standing Order (SO) O-23 on a monthly basis. The applicant indicated that the pressure differential transients due to RCP stops and starts are not counted because the number specified (4000) is conservative. The applicant also identified several transients that are not counted under this procedure. These cycles involve power changes, operating pressure and temperature variations, and feedwater additions with the plant in hot standby conditions. The applicant indicated that these cycles will be conservatively estimated from a review of plant operating records to predict current cycles under the FMP. Once current number of cycles has been established, a review will be performed to determine if there is a potential for exceeding the allowable cycles and should be managed. If so, they'll be counted and managed by the FMP.

The applicant's response did not provide a cycle count for chemical and volume control system (CVCS) transients identified in LRA Section 4.3. In addition, Note 1 to the response to Item 1 implies that some transients may not be monitored by the FMP, whereas the response to Item 3 indicates that all transients will be monitored either directly or indirectly by the FMP. By letter dated February 20, 2003, the staff issued POI-13(c), requesting the applicant to provide additional clarification regarding how these transients are monitored by the FMP. Specifically, the applicant was requested to provide a cycle count for CVCS transients and clarify the difference between the Item 1, Note 1, and Item 3 responses.

By letter dated March 14, 2003, the applicant provided its response to POI-13(c). The applicant provided the current cycle counts for the CVCS transients identified in LRA Section 4.3. The applicant indicated that the cycle counts for some of the CVCS transients are based on gross estimates due to incomplete data logs. The applicant stated that a condition report (CR) would be generated to obtain a more accurate transient count prior to entry into the period of extended operation. The applicant indicated that transients associated with the regenerative heat exchanger isolation and loss of letdown are the most limiting transients with regard to thermal fatigue of the CVCS system. The applicant's statement is consistent with the results of the charging nozzle evaluation presented in NUREG/CR-6260. The applicant's response also indicates that the regenerative heat exchanger and loss of letdown transients are based on actual cycle counts. The staff notes that the estimated cycles for all the CVCS transients are well below the number of design transients and that the number of CVCS transients would not be expected to exceed the number of design cycles during the period of extended operation.

The applicant indicated that transients with low volume control tank level and boron dilution would not be counted by the FMP because they resulted in insignificant fatigue usage. The applicant also indicated that FCS is a base-loaded plant whereas several of the cycle estimates provided in item 1 of the December 19, 2002, response were based of the assumption of load following. These include the operating and power change cycles. The applicant indicated that the number of cycles of these transients is expected to be well below the number of design cycles for the period of extended operation. This is consistent with the results presented in NUREG/CR-6260. The staff concludes that the applicant has provided sufficient information to assure that the thermal design transients that are significant contributors to the fatigue usage of RCS components will be monitored by the FMP. Therefore, POI-13(c) is resolved.

In response to RAI 4.3.1-1, Item 3, submitted to the staff by letter dated December 19, 2003, the applicant indicated that all design basis transients will be included in the FMP. The applicant indicated that a program basis document (PBD) would be generated to capture both the current and increased scope of the FMP which includes incorporation of automated cycle counting and the analysis for environmentally-assisted fatigue. The applicant committed to complete the PBD and implement the enhanced FMP prior to the period of extended operation.

Section A.2.10 of the LRA provides the FMP USAR Supplement. The Supplement indicates that the automated cycle counting software "FatiguePro" will be used to monitor thermal fatigue of the components in the program. The Supplement also indicates that an FCS site-specific evaluation is being performed to address environmental fatigue and that appropriate program enhancements will be made prior to the period of extended operation. However, Section 4.3.2 of the LRA indicates that the environmental fatigue evaluations are complete. In RAI 4.3.2-2, the staff requested the applicant to address the apparent discrepancy.

The applicant's December 12, 2002, response to RAI 4.3.2-2 indicated that the environmental fatigue evaluations are complete, and the analysis shows that the surge line is the only location where the CUF may exceed 1.0 during the period of extended operation. The applicant further indicated that the environmental fatigue of the surge line will be included in the FMP. By letter dated February 20, 2003, the staff issued POI-13(d) requesting the applicant to revise the USAR Supplement to describe the completed environmental fatigue evaluation. By letter dated April 4, 2003, the applicant provided the requested USAR Supplement revision. Therefore, this part of POI-13(d) is resolved.

The applicant indicates that the FMP will continue during the period of extended operation and will assure that design cycle limits are not exceeded. The applicant's FMP tracks transients and cycles of RCS components that have explicit design transient cycles to assure that these components stay within their design basis. Generic Safety Issue (GSI)-166, "Adequacy of the Fatigue Life of Metal Components," raised concerns regarding the conservatism of the fatigue curves used in the design of the RCS components. Although GSI-166 was resolved for the current 40-year design life of operating components, the staff identified GSI-190, "Fatigue Evaluation of Metal Components for 60-Year Plant Life," to address license renewal. The NRC closed GSI-190 in December 1999, concluding:

> The results of the probabilistic analyses, along with the sensitivity studies performed, the iterations with industry (NEI and EPRI), and the different approaches available to the licensees to manage the effects of aging, lead to the conclusion that no generic regulatory action is required, and that GSI-190 is closed. This conclusion is based primarily on the negligible calculated increases in core damage frequency in going from 40 to 60 year lives. However, the calculations supporting resolution of this issue, which included consideration of environmental effects, and the nature of age-related degradation indicate the potential for an increase in the frequency of pipe breaks as plants continue to operate. Thus, the staff concludes that, consistent with existing requirements in 10 CFR 54.21, licensees should address the effects of coolant environment on component fatigue life as aging management programs are formulated in support of license renewal.

The applicant evaluated the component locations listed in NUREG/CR-6260 that are applicable to an older vintage Combustion Engineering (CE) plant for the effect of the environment on the fatigue life of the components. The applicant also indicated that the later environmental fatigue correlations contained in NUREG/CR-6583, "Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low-Alloy Steels," and NUREG/CR-5704, "Effects of LWR Coolant Environments on Fatigue on Fatigue Design Curves of Austenitic Stainless Steels," were considered in the evaluation. In RAI 4.3.2-1, the staff requested that the applicant provide the results of the usage factor evaluation for each of the six component locations listed in NUREG/CR-6260.

The applicant's December 19, 2002, response provided the calculated environmental usage factors for the six component locations listed in NUREG/CR-6260. The calculated usage factors are less than 1.0 for all components except for the surge line elbow. The applicant's response indicates that the usage factors for two components, the surge line elbow and the charging line nozzle, were based on anticipated cycles for a 60-year plant life consistent with Table 5-32 of NUREG/CR-6260. The statement in the applicant's response is not clear to the staff. By letter dated February 20, 2003, the staff issued POI-13(e), requesting that the applicant clarify that the evaluations are based on the number of anticipated cycles for 60 years of operation at FCS. The staff also requested the applicant to clarify that the number of cycles assumed in these evaluations is included in the FMP to provide assurance that the evaluations remain valid during the period of extended operation.

By letter dated March 14, 2003, the applicant responded to POI-13(e). The applicant indicated that the number of cycles assumed for the evaluation of the charging line nozzle will be included in the FMP basis document to assure that the CUF of 1.0 is not exceeded during the period of extended operation. The staff finds the applicant's commitment to include the number of cycles used in the evaluation of the charging nozzle in the FMP acceptable. The applicant also indicated that further evaluation of the surge line elbow will be required prior to entry into the period of extended operation. The applicant will include this commitment in its USAR Supplement as discussed in its response to POI-13(d). The staff concludes the applicant's commitments are sufficient to assure that the effect of the environment on the fatigue life of the charging nozzle and the surge line elbow will be adequately addressed during the period of extended operation. Therefore, POI-13(e) is resolved.

The results of the applicant's evaluation are consistent with the results presented in NUREG/CR-6260 for an older vintage CE plant. NUREG/CR-6260 also identified the surge line elbow as the only component where the environmental usage factor may exceed 1.0 during the period of extended operation. The staff concludes that the applicant's results are reasonable based on comparison with the results presented in NUREG/CR-6260.

Section 4.3.2 of the LRA contained a discussion of the proposed AMP to address fatigue of the FCS pressurizer surge line. The discussion indicated that the AMP will consist of an inspection program. The LRA also indicated that the results of the surge line inspections will be used to assess the appropriate approach for addressing environmentally-assisted fatigue of the surge lines. However, Section 4.3.3 of the LRA indicated that a reevaluation of the fatigue usage of critical areas of the surge line will be performed prior to the period of extended operation and that the bounding locations will be included in the FMP. In RAI 4.3.2-3, the staff requested that the applicant describe how the effect of the reactor water environment will be considered in the reevaluation of the critical areas of the surge line and how the results of this evaluation will be monitored by the FMP.

The applicant's December 19, 2002, response indicated that the limiting surge line welds would be inspected prior to the period of extended operation. The applicant further indicated that the results of these inspections will be used to assess the appropriate approach for addressing environmentally-assisted fatigue of the surge lines. The applicant indicated that the approach would include one or more of the following four options.

1. further refinement of the fatigue analysis to lower the CUF(s) to below 1.0
2. repair of the affected locations
3. replacement of the affected locations
4. management of the effects of fatigue by an inspection program that has been reviewed and approved by the NRC (e.g., periodic nondestructive examination of the affected locations at inspection intervals to be determined by a method accepted by the NRC)

The applicant committed that, if Option 4 were to be selected, it will provide the inspection details, including scope, qualification method, and frequency, to the NRC staff for review and approval prior to the period of extended operation. An AMP under this option would be a departure from the design basis CUF evaluation described in the USAR Supplement, and therefore would require a license amendment pursuant to 10 CFR 50.59. This was identified as Confirmatory Item 4.3.2-1.

By letter dated July 7, 2003, the applicant formalized this commitment. The staff finds this acceptable. Confirmatory Item 4.3.2-1 is closed.

The staff finds the applicant’s proposed program an acceptable plant-specific approach to address environmentally-assisted fatigue during the period of extended operation in accordance with 10 CFR 54.21(c)(1). However, in accordance with 10 CFR 54.21(d), this information needs to be added to the USAR Supplement. By letter dated February 20, 2003, the staff issued POI-13(d), requesting this addition to the USAR Supplement.

By letter dated April 4, 2003, the applicant provided the requested USAR Supplement revision. Therefore, this part of POI-13(d) is resolved.

Section 4.3.4 of the LRA contained a discussion of the analysis of Class II and III components at FCS. American National Standards Institute (ANSI) B31.1 requires that a reduction factor be applied to the allowable bending stress range if the number of full-range thermal cycles exceeds 7000. The LRA indicated that the USAS B31.1 limit of 7000 equivalent full-range cycles may be exceeded during the period of extended operation for the nuclear steam supply system (NSSS) sampling system and that the affected portions of the NSSS sampling system would be tracked by the FMP. In RAI 4.3.4-1, the staff requested that the applicant provide the calculated thermal stress range for these affected portions of the NSSS sampling system.

The applicant’s December 12, 2002, response indicated that the small bore piping at FCS was designed and supported based on nomographs developed in accordance with the USAS B31.1 code. Because the applicant used nomographs, there are currently no specific stress calculations. The applicant committed that, as part of the FMP, the sampling piping will be analyzed and a stress calculation performed to determine the thermal stress range for the line when the sampling line exceeds 7000 cycles. The applicant should confirm that the results, when completed, will meet USAS B31.1. This was identified as Confirmatory Item 4.3.2-2.

By letter dated July 7, 2003, the applicant formalized this commitment and confirmed that the stress calculation results for the small bore sampling system piping, when completed, will meet USAS B31.1 requirements. The staff finds this acceptable. Confirmatory Item 4.3.2-2 is closed.

The applicant’s USAR Supplement for metal fatigue is provided in Sections A.2.10 and A.3.2 of the LRA, which includes a description of the FMP. By letter dated April 4, 2003, the applicant updated Section A.2.10 of the USAR Supplement to provide a more detailed discussion of the proposed program to address environmental fatigue effects. The staff finds the applicant’s proposed USAR Supplement provides an acceptable description of the FCS fatigue TLAA evaluation and the FCS program to manage thermal fatigue during the period of extended operation to satisfy 10 CFR 54.21(d).

4.3.3 Conclusions

The staff has reviewed the applicant's metal fatigue TLAA and concludes that the applicant's actions and commitments will ensure that the subject components will be adequately managed during the period of extended operation to satisfy 54.21(c)(1).

The staff has also reviewed the revised USAR Supplement for the TLAA and finds that it is an adequate description of the metal fatigue TLAA to satisfy 10 CFR 54.21(d).

4.4 Environmental Qualification

4.4.1 Environmental Qualification Program TLAA

The 10 CFR 50.49 environmental qualification (EQ) program has been identified as a TLAA for the purpose of license renewal. EQ components include all long-lived, passive and active electrical and I&C components and commodities that are located in a harsh environment and are important to safety, including safety-related and Q-list equipment, non-safety-related equipment whose failure could prevent satisfactory accomplishment of any safety-related function, and the necessary post-accident monitoring equipment.

The staff has reviewed Section 4.4, "Environmental Qualification," of the LRA to determine whether the applicant submitted adequate information to meet the requirements of 10 CFR 54.21(c)(1) for evaluating the EQ TLAA. 10 CFR 54.21(c)(1) requires that a list of EQ TLAAs be provided. It also requires demonstration that (i) the analyses remain valid for the period of extended operation, (ii) the analyses have been projected to the end of the period of extended operation, or (iii) the effect of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff also reviewed Section 4.4.3.4, "EQ Generic Safety Issue (GSI-168) for Electrical Components," of the LRA.

4.4.1.1 Summary of Technical Information in the Application

The FCS EQ program complies with all applicable regulations and manages equipment thermal, radiation, and cyclic aging through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. Environmentally qualified equipment must be refurbished, replaced, or have its qualification extended prior to reaching the aging limits established in the aging evaluation. Aging evaluations for environmentally-qualified equipment that specify a qualified life of at least 40 years are considered TLAAs for license renewal.

The FCS Electrical Equipment Qualification (EEQ) program has been established to implement the requirements of the EQ Rule, 10 CFR 50.49. The program provides for necessary procedural controls to ensure that appropriate and timely changes are implemented. The qualified life of an equipment type is determined by the ambient environmental conditions to which it is exposed for the predicted period, internal heat rise, and cyclic stresses. Also, the qualified life of equipment can be affected by changes in plant design and operating conditions; therefore, the qualified life of equipment is frequently revisited to determine if any changes have occurred that would potentially affect the life of the equipment. The applicant routinely performs recalculations of qualified life as well as updates to equipment performance characteristics under the current EQ program. The applicant's EQ program addresses the effects of aging to ensure that the required electrical equipment function is maintained and qualified throughout its installed life. The EEQ program at FCS accomplishes the following to meet the requirements of the EQ Rule:

- reviews original qualified life bases
- establishes margin/uncertainty limits for qualified life
- reviews available aged specimen test data for impact on, and validation of, margin/uncertainty
- reviews any data for impact on, and validation of, margin/uncertainty
- adjusts qualified life based on consideration of analytical and test data and refurbishment without violating the qualification margin/uncertainty limits
- establishes new replacement dates for qualified equipment based on emergent issues, new data, industry experience, etc., as appropriate in accordance with plant and 10 CFR 50.49 program procedures

The applicant states in Section 4.4.3 of the LRA that all significant effects from normal service conditions are considered in accordance with 10 CFR 50.49 requirements. The normal service conditions include expected aging effects from normal temperature exposure, any radiation effects during normal plant operation, and cyclic aging. The applicant states that during the period of extended operation, a reevaluation of the aging effects will be performed to determine whether the equipment can continue to support the intended pre-accident service while continuing to maintain the capability to perform its post-accident intended function. The applicant states that existing analyses for thermal aging of all equipment within the FCS EQ program will be reviewed to determine if the existing calculations remain valid for the period of extended operation, or if additional analysis will be required to demonstrate qualification through the period of extended operation. Also, the total integrated dose for the 60 years will be established by making the assumption that it is equal to 1.5 times the normal operating dose for 40 years. The total integrated dose for the period of extended operation (60 years) will then be compared to the qualification level to ensure that the required total integrated dose is enveloped for the equipment. If the total integrated dose is higher than the qualification value of the equipment, then the equipment qualified life will be reassessed prior to the end of 40 years of qualified life.

The applicant has chosen option iii of the 10 CFR 54.21(c)(1) in its TLAA evaluation to demonstrate that the aging effects of the EQ equipment identified in this TLAA will be managed during the period of extended operation by the EQ program activities. The applicant states in Section 4.4.4, “Conclusion,” of the LRA that aging effects of the EQ equipment identified in this TLAA will be managed during the period of extended operation consistent with NUREG-1801, “Generic Aging Lessons Learned (GALL) Report,” dated July 2001, program X.E1, “Environmental Qualification (EQ) of Electrical Components.”

4.4.1.2 Staff Evaluation

The staff reviewed Sections 4.1.1 and 4.4 of the LRA to determine whether the applicant submitted adequate information to meet the requirements of 10 CFR 54.21(c)(1).

For the electrical equipment identified in LRA Table 4.1-1, the applicant uses 10 CFR 54.21(c)(1)(iii) in its TLAA evaluation to demonstrate that the aging effects of the EQ equipment identified in this TLAA will be adequately managed during the period of extended operation.

The staff reviewed the EQ program information in the LRA to determine whether it will assure that the electrical and I&C components covered under this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation. The staff's evaluation of the component qualification focused on how the EEQ program manages the aging effects to meet the requirements delineated in 10 CFR 50.49.

The applicant stated that the EEQ program manages component thermal, radiation, and cyclical aging through the use of aging evaluations based on 10 CFR 50.49 qualification methods. Also, the applicant stated that during the period of extended operation, a re-evaluation of the aging effects will be performed to determine whether the equipment can continue to support the intended pre-accident service while continuing to maintain the capability to perform its post-accident intended function.

The applicant also stated that the EEQ program is consistent with GALL program XE1, "Environmental Qualification (EQ) of Electric Components." The continued application of 10 CFR 50.49 to EQ components that are qualified for the current qualified life for license renewal is acceptable to the staff because the EQ program has provided satisfactory management of electrical components within the program. The staff concludes that the EEQ program is capable of programmatically managing the qualified life of the components falling within the scope of the program for license renewal. The continued implementation of the FCS EEQ program provides assurance that the aging effects will be managed and that components falling within the scope of the EEQ program will continue to perform their intended functions for the period of extended operation. Thus, because the applicant will manage electrical components within the EQ program in accordance 10 CFR 50.49 for the period of extended operation, the staff finds the applicant's approach meets the requirements of 10 CFR 54.21(c)(1)(iii) and is acceptable.

The staff also reviewed the USAR Supplement for this TLAA and concludes that it provides an adequate summary description of the TLAA to satisfy 10 CFR 54.21(d).

4.4.1.3 Conclusions

On the basis of the review described above, the staff has determined that the applicant has evaluated the TLAA for EQ of electrical equipment consistent with 10 CFR 54.21(c)(1)(iii). The commitment made in the LRA that aging effects of the EQ equipment identified in the TLAAs will be managed during the period of extended operation consistent with GALL program X.E1, is in agreement with the GALL Report conclusion that plant EQ programs, which implement the requirements of 10 CFR 50.49, are viewed as acceptable aging management programs for license renewal under 10 CFR 54.21(c)(1)(iii).

The staff also reviewed the USAR Supplement for this TLAA and concludes that it provides an adequate summary description of the TLAA to satisfy 10 CFR 54.21(d).

4.4.2 GSI-168, "Environmental Qualification of Low-Voltage Instrumentation and Control (I&C) Cables"

During the staff's review of license renewal issues, the EQ process was found to be a significant issue. Of particular concern was whether the EQ requirements for older plants, whose licensing bases differ from newer plants, are adequate for license renewal. Further, a question was raised as to whether the EQ requirements for older plants should be reassessed for the current licensing term. Upon subsequent review, additional concerns were raised related to the EQ process, and it was concluded that differences in EQ requirements constituted a potential generic issue that should be evaluated for backfit, independent of license renewal. This came to be identified as Generic Safety Issue (GSI)-168. Key items to be addressed in GSI-168 are:

- the adequacy of older EQ requirements for license renewal, as well as the current licensing term

- the adequacy of accelerated aging techniques to simulate long-term natural service aging

- the possibility that unique failure mechanisms exist for bonded jacket and multi-conductor cable configurations that are not adequately addressed in EQ

- the feasibility of using condition monitoring techniques to monitor current cable condition in situ as a means of offsetting uncertainties in the process used to predict long-term service aging

The staff has provided guidance to the industry (letter dated June 2, 1998 from the NRC (Grimes) to the Nuclear Energy Institute (NEI) (Walters)), which states:

- GSI-168 issues have not been identified to a point that a license renewal applicant can be reasonably expected to address these issues specifically at this time

- an acceptable approach is to provide a technical rationale demonstrating that the CLB for EQ will be maintained in the period of extended operation.

For the purpose of license renewal, as discussed in the Statements of Consideration (SOC) (60 FR22484, May 8, 1995), there are three options for addressing issues associated with a GSI:

- If the issue is resolved before the renewal application is submitted, the applicant can incorporate the resolution in the LRA.

- An applicant can submit a technical rationale that demonstrates that the CLB will be maintained until some later point in the period of extended operation, at which time one or more reasonable options would be available to adequately manage the effects of aging.

- An applicant can develop a plant-specific aging management program that incorporates the resolution of the aging issue.

4.4.2.1 Summary of Technical Information in the Application

The applicant states that since environmental qualification is a TLAA for license renewal, outstanding GSIs that could affect the validity of any credited analyses must be dispositioned as part of the application process. GSI-168 remains unresolved, and for the purposes of license renewal, there are three options for resolving issues associated with a GSI.

1. If the issue is resolved before the renewal application is submitted, the applicant can incorporate the resolution in the LRA.

2. An applicant can submit a technical rationale that demonstrates that the CLB will be maintained until some later point in the period of extended operation, at which time one or more reasonable options would be available to adequately manage the effects of aging.

3. An applicant can develop a plant-specific aging management program that incorporates the resolution of the aging issue.

The applicant states that it has chosen to pursue the second option, so until GSI-168 is resolved, aging management of qualified cables will be addressed through plant-specific programs. At that time, one or more reasonable options should be available to adequately manage the effects of aging.

4.4.2.2 Staff Evaluation

As stated above, there are three options for addressing issues associated with a GSI:

1. If the issue is resolved before the renewal application is submitted, the applicant can incorporate the resolution in the LRA.

2. An applicant can submit a technical rationale that demonstrates that the CLB will be maintained until some later point in the period of extended operation, at which time one or more reasonable options would be available to adequately manage the effects of aging.

3. An applicant can develop a plant-specific aging management program that incorporates the resolution of the aging issue.

The applicant has chosen to pursue Option 2 with regard to GSI-168. This option requires the applicant to provide a technical rationale that demonstrates that the CLB will be maintained until some later point in the period of extended operation, at which time one or more reasonable options would be available to adequately manage the effects of aging. The research and technical assessment of GSI-168 is limited to low-voltage instrumentation and control (I&C) cables in harsh environments. GSI-168 does not encompass any other electrical equipment or components. As such, the applicant's technical rationale provided in the LRA on GSI-168 addresses cables that are captured in GSI-168. No additional rationale is needed from the applicant.

The existing EQ program at FCS complies with all applicable regulations and manages equipment thermal, radiation and cyclic aging through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. The plant will continue to use these methods to manage the qualification of I&C cables until such time as GSI-168 is resolved. The applicant has committed to incorporate the resolution of GSI-168 into the extended period of operation. The staff finds the applicant's response acceptable.

4.4.3 Conclusions

On the basis of its review, the staff concludes that the applicant has addressed the issues associated with GSI-168. The applicant will continue to manage the effects of aging through plant-specific programs in accordance with the CLB until some later point in the period of extended operation, at which time one or more reasonable options would be available to adequately manage the effects of aging. The staff finds that the applicant has satisfactorily addressed GSI-168 for license renewal, as required by 10 CFR 54.21(c)(1)(iii). The staff issued Regulatory Issue Summary (RIS) 2003-09 on May 2, 2003, to inform addressees of the results of the technical assessment of GSI-168. This RIS on GSI-168 requires no actions on the part of addressees. Therefore, the staff considers the GSI-168 issue to be closed.

The staff also reviewed the USAR Supplement for this TLAA and concludes that it provides an adequate summary description of the TLAA to satisfy 10 CFR 54.21(d).

4.5 Concrete Containment Tendon Prestress

The prestressing tendons in prestressed concrete containments lose their prestressing forces with time due to creep and shrinkage of concrete and relaxation of the prestressing steel. During the design phase, engineers estimate these losses to arrive at the prestressing forces at the designated operating life, normally 40 years. The operating experience with the trend of prestressing forces indicates that the prestressing tendons lose their prestressing forces at a rate higher than predicted due to sustained high temperature. Thus, it is necessary to perform TLAAs for the period of extended operation. The adequacy of the prestressing forces in prestressed concrete containments is reviewed for the period of extended operation.

4.5.1 Summary of Technical Information in the Application

The applicant describes its TLAA for prestressing force for the FCS containment as follows:

> Pre-stressing tendon integrity is monitored and confirmed by the containment ISI program (B.1.3). The program provides for tendon inspection 1, 2 and 4 years after initial pre-tensioning, and every five years thereafter for the remaining life of the plant. The pre-stressing tendon surveillances are performed in accordance with NRC Regulatory Guide 1.35 revision 3, as implemented in Amendment 139 to the FCS operating license.
>
> Curves showing anticipated variation of tendon force with time, together with the lower limit curves to be applied to surveillance readings, are shown in the FCS USAR. The curves are given in terms of net force in the tendon and as a percentage of the initial tendon load. The calculated pre-stress at end of plant life exceeds by a reasonable margin the intensity required to meet the design criteria. This margin is the basis of the limits set for deviation with time of the tendon forces as measured by the periodic lift-off readings. If at any time surveillance testing indicates a decrease in the tendon force below the given limit line, corrective action will be taken in accordance with the Technical Specifications. The USAR curves will be extended to 60 years of plant life to cover the period of extended operation. This will also show that the pre-stressing force is acceptable for continued service at the end of the period of extended operation considering the assumed time dependent nature of pre-stress losses. The tendon surveillance program will be continued into the period of extended operation using the updated curves. Therefore, the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

In Section A.3.4 of the USAR Supplement, the applicant summarizes the TLAA and concludes that the calculated prestress at the end of plant life exceeds by a reasonable margin the intensity required to meet the design criteria.

4.5.2 Staff Evaluation

The staff's review of the TLAA indicated that the applicant was missing an important acceptance criterion in the description of the TLAA. In RAI 4.5-1, the staff requested information regarding this acceptance criterion as follows:

> For acceptance criterion for tendon prestressing force, the LRA states: "If at any time surveillance testing indicates a decrease in the tendon force below the given limit line, corrective action will be taken in accordance with the Technical Specifications." This is one of the criterion (sic) in IWL-3221. Additionally, 10 CFR 50.55a(b)(2)(viii)(B) requires: "When evaluation of consecutive surveillance's of prestressing forces for the same tendon or tendons in a group indicates a trend of prestressing loss such that the tendon forces will be less than the minimum design prestress requirements before the next inspection interval, an evaluation must be performed and reported in the Engineering Evaluation Report as prescribed in IWL-3300." Based on these requirements, the staff requests the applicant to clarify whether the acceptance criterion in the LRA complies with the requirements of IWL-3221 and 10 CFR 50.55a(b)(2)(viii)(B).

In response, the applicant stated that the acceptance criterion in the LRA does comply with IWL-3221 and 10 CFR 50.55a(b)(2)(viii)(B). A regression analysis of forces measured on specific tendons was conducted and included in the tendon testing report. The analysis showed satisfactory results for the next surveillance. Furthermore, the applicant provided detailed information regarding the process used to comply with the regulation in Appendix C attached to its letter dated March 14, 2003. The staff reviewed the process and the curves indicating future trends with respect to the minimum required prestress for each group of tendons. The staff found that the process satisfied 10 CFR 50.55a(b)(2)(viii)(B), and is therefore acceptable.

The applicant did not provide adequate quantitative evaluation based on the prior tendon inspections. In RAI 4.5-2, the staff requested the following information:

> Title 10 CFR 50.55a(b)(2)(viii)(B) requires the development of a trend line of measured prestressing forces so that the licensee can decide whether the prestressing tendon forces during the next inspection interval will remain above the "Lower Limit - Dome," and "Lower-Limit-Wall," as plotted in USAR Figure 5.10-3. The applicant addresses this TLAA using Section X.S1 of the GALL Report, as part of its operating experience. In order to confirm that the prestressing tendon forces will remain above the lower limits for the dome and wall during the period of extended operation, the staff requests that the applicant provide information related to the trend lines for wall and dome tendons compared to the established lower limits. Guidance for statistical considerations in developing the trend lines is given in Attachment 3 of IN 99-10, Revision 1, "Degradation of Prestressing Tendon Systems in Prestressed Concrete Containments."

In response, the applicant stated that because it is using 10 CFR 54.21(c)(1)(iii), i.e managing the TLAA, it need not provide such information. However, the staff needs the quantitative data of trend lines, as part of the operating experience, to make a conclusion regarding this TLAA for the period of extended operation. In Appendix C to its March 14, 2003, letter, the applicant provided the quantitative trend lines based on the containment tendon inspections performed thus far at FCS. It should be noted that the future prestressing force measurements could change the predictions. However, because the applicant is going to continue monitoring the tendon forces as required by ASME Section XI, Subsection IWL, the staff finds the process, and the quantitative data provided by the applicant in its March 14, 2003, letter, acceptable.

The staff reviewed the USAR Supplement for this TLAA and concluded that it provides an adequate summary description of the TLAA.

4.5.3 Conclusions

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that based on the operating experience related to the tendon prestressing forces, the identified aging management program will adequately mange the containment tendon prestressing forces during the period of extended operation. The staff also reviewed the USAR Supplement and concluded that it contains an appropriate summary description of the concrete containment tendon prestress TLAA evaluation for the period of extended operation, as reflected in the current licensing basis, to satisfy 10 CFR 54.21(d). Therefore, the staff finds that the safety margins established and maintained during the current operating term will be maintained during the period of extended operation, as required by 10 CFR 54.21(c)(1).

The staff also reviewed the USAR Supplement for this TLAA and concludes that it provides an adequate summary description of the TLAA to satisfy 10 CFR 54.21(d).

4.6 Containment Liner Plate and Penetration Sleeve Fatigue

The interior surface of a concrete containment structure is lined with thin metallic plates to provide a leak-tight barrier against the uncontrolled release of radioactivity to the environment, as required by 10 CFR Part 50. The thickness of the liner plates is generally between 1/4 inch (6.2 mm) and 3/8 inch (9.5 mm). The liner plates are attached to the concrete containment wall by stud anchors or structural rolled shapes, or both. The design process assumes that the liner plates do not carry loads. However, normal loads, such as from concrete shrinkage, creep, and thermal changes, imposed on the concrete containment structure are transferred to the liner plates through the anchorage system. Internal pressure and temperature loads are directly applied to the liner plates. Thus, under design basis conditions, the liner plates could experience significant strains.

Fatigue of the liner plates may be considered in the design based on an assumed number of loading cycles for the current operating term. The cyclic loads include reactor building interior temperature variation during the heatup and cooldown of the reactor coolant system, a LOCA, annual outdoor temperature variations, thermal loads due to high-energy containment penetration piping lines (such as steam and feedwater lines), seismic loads, and pressurization due to periodic Type A integrated leak rate tests.

The containment liner plates, penetration sleeves (including dissimilar metal welds), and penetration bellows may be designed in accordance with the requirements of Section III of the ASME Boiler and Pressure Vessel Code. If a plant's code of record requires a fatigue analysis, then this analysis may be a TLAA and must be evaluated in accordance with 10 CFR 54.21(c)(1) to ensure that the effects of aging on the intended functions will be adequately managed for the period of extended operation.

The adequacy of the fatigue analyses of the containment liner plates (including welded joints), penetration sleeves, dissimilar metal welds, and penetration bellows is reviewed for the period of extended operation. The fatigue analyses for the pressure boundary of process piping are reviewed in Section 4.3 of this SER, following the guidance in Section 4.3 of the SRP-LR.

4.6.1 Summary of Technical Information in the Application

The applicant discussed the design of the FCS containment liner and penetration sleeves in Section 4.6 of the LRA. The applicant indicated that the containment linear and penetration sleeves were designed using the ASME Code, Section III, “Nuclear Vessels,” as a guide in the determination of acceptable strains. The applicant also indicated that the liner reinforcement at all penetrations meets the requirements of the ASME Code, Section III, “Class B Vessels,” and that the penetration design and materials conform to the requirements of the ASME Code, Section III, “Nuclear Vessels.” The applicant indicated that fatigue considerations were of prime importance in the design of the liner and attachments and that the following fatigue loadings were assumed for the design:

- thermal cycling caused by one loss-of-coolant accident
- thermal cycling caused by variation of annual outdoor temperatures (40 cycles)
- thermal cycling caused by variation of internal temperature between shutdown and operating conditions (500 cycles)

The applicant indicated that the design CUF for the liner plate and attachments was 0.05. The applicant indicated that this value was computed based on an assumed inward curvature of the liner plate between stiffeners of 1/16 inch. The applicant indicated that actual measurements of the containment liner found values of 1/4 to 3/4 inch. The applicant indicated that this condition was evaluated and found acceptable for the current term.

4.6.2 Staff Evaluation

The design of the FCS liner and anchorage system is described in Sections 5.5 and 5.6 of the USAR. The USAR indicates that the 1/4-inch thick liner is anchored at 14-1/2 inch centers by continuous structural tees. Section 5.6 of the USAR indicates that an analysis of the liner steel was performed for 500 cycles of operating conditions, and the calculated CUF of 0.05 was compared with an allowable value of 1.0 permitted by ASME, Section III, N415.2(e)(6). The USAR also indicates that an inward curvature of 1/16 inch of a single panel was assumed in the analysis of the linear plate for the most critical case. As discussed previously, the applicant indicated that actual measurements found larger displacements and that an analysis of the as-found displacements for the 60-year period would be completed prior to the period of extended operation. In RAI 4.6-1, the staff requested that the applicant describe the analysis that was performed to show the containment liner plate/penetration sleeve meets acceptance criteria for the current term and to provide the calculated usage factor obtained from this analysis.

In its December 12, 2002, response, the applicant indicated that the recent analysis of the as-found buckling of the liner plate was performed using non-linear, 3D finite element analysis with loads applied in a fashion similar to the original analysis. The applicant indicated that an undeformed panel was evaluated using the new model to benchmark the new model against results from a comparable model from the original analysis. The applicant indicated that the new analysis resulted in a CUF of 0.141 for the 500 cycles of internal temperature variation due to heatup and cooldown. The applicant further indicated that 500 cycles is greater than the number of cycles expected for 60 years of plant operation. This is consistent with the applicant's response to RAI 4.3.1-1, which indicates that there have been 66 cycles of heatup and cooldown of the RCS in approximately 30 years of plant operation. The staff also notes that the number of heatup and cooldown cycles is being tracked by the FCS FMP. By letter dated February 20, 2003, the staff issued POI-13(h), requesting that the applicant verify that the thermal cycling due to outdoor temperature variation does not result in significant fatigue usage. The staff also requested that the applicant clarify whether the current evaluation bounds the fatigue usage in the penetration area.

By letter dated March 14, 2003, the applicant responded to POI-13(h). The applicant indicated that the analysis of the as-found buckling of the liner plate included cyclic conditions for outdoor air annual temperature changes and LOCA transients, and that the contribution to the fatigue usage factor from the outdoor air temperature variations was insignificant. The applicant further indicated that the containment liner plate buckling was remote from the penetration area and, therefore, the buckling had no effect on the stresses and fatigue usage at the penetration. The staff finds the applicant has adequately addressed the cyclic design loads in the fatigue evaluation of the liner plate buckling. Therefore, POI-13(h) is resolved.

The applicant provided a summary description of the containment liner plate and penetration sleeve fatigue TLAA in Section A.3.5 of the USAR Supplement. The applicant indicated that an evaluation of the liner plate as-found buckling for a 60-year life will be completed prior to the period of extended operation. By letter dated February 20, 2003, the staff issued POI-13(i) requesting the applicant to update the USAR Supplement to indicate that the evaluation is complete and to provide the evaluation results. By letter dated March 14, 2003, the applicant provided the requested USAR revision. POI-13(i) is resolved.

4.6.3 Conclusions

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1) that, for the containment liner plate and penetrations fatigue TLAA, (i) the analyses remain valid for the period of extended operation. The staff also concludes that the USAR Supplement contains an appropriate summary description of the containment liner plate and penetration sleeve fatigue TLAA, as required by 10 CFR 54.21(d).

4.7 Other TLAAs

There are certain plant-specific safety analyses that may have been based on an explicitly assumed 40-year plant life and may, therefore, be TLAAs. Pursuant to 10 CFR 54.21(c)(1), a license renewal applicant is required to evaluate TLAAs, as defined in 10 CFR 54.3. License renewal reviews focus on the period of extended operation.

The applicant has identified three additional TLAAs for license renewal:

- reactor coolant pump flywheel fatigue
- leak-before-break analysis for resolution of USI A-2
- high-energy line break (HELB)

The staff's evaluation of these TLAAs is provided below.

4.7.1 Reactor Coolant Pump (RCP) Flywheel Fatigue

4.7.1.1 Summary of Technical Information in the Application

General Electric Designed (GE-design) RCP Flywheels

The applicant stated that General Electric (GE) manufactured the original RCP motors and that each GE pump motor is provided with a flywheel that reduces the rate of flow decay upon loss of pump power. The applicant stated that conservative design bases and stringent quality control measures have been taken to preclude failure of the flywheel and that the following design features for the GE-designed RCP flywheels ensure that the requirements for structural soundness were met:

- division of the mass into three separate discs
- a keyway fillet radius not less than 1/8 inch to minimize stress concentrations
- fabrication of the discs using forged carbon steel plate having different tensile strengths

The applicant stated that the resistance of the GE-designed RCP flywheels to rupture was examined at 120 percent overspeed, and that the critical crack length for the disc most susceptible to crack propagation was found to be 3 inches, as based on fracture mechanics data furnished by GE and the assumption that the crack extended radially outward from the flywheel's keyway and penetrated completely through the thickness of the disc. Using the crack growth prediction techniques provided by GE, the applicant concluded that more than 185,000 complete cycles from 0 to 120 percent overspeed would be required to cause a 0.5 inch long crack extending radially from the keyway to grow to critical size. This number of cycles will not be exceeded if the licensing period is extended to 60 years. To do so would require in excess of eight pump starts per day, which far exceeds actual and projected pump use. Since the cycle limit will not be exceeded, the applicant concluded that fatigue crack growth analysis for the GE-design RCP flywheels remains valid for the period of extended operation.

ABB Design RCP Flywheel (ABB-design, flywheel for the RCP No. RC-3B)

The applicant stated that during the 1996 refueling outage, the RCP RC-3B motor was replaced with a motor manufactured by ABB Industries. The applicant stated that the flywheel was conservatively designed and made with closely controlled quality material such that the probability of a flywheel failure is sufficiently small and that, therefore, a steel shroud was not included in the flywheel design.

The applicant stated that the ABB-designed RCP flywheel was made from forged ASTM A508 4/5 steel and shrink-fitted to the shaft collar and that the flywheel was designed, manufactured, and tested per the guidance of RG 1.14, Revision. 1, "Reactor Coolant Pump Flywheel Integrity," dated August, 1975. The applicant stated that a crack growth analysis was performed by ABB, which demonstrated that critical flaw growth would not occur with fewer than 10,000 complete cycles (RCP startups) from 0 to 120 percent overspeed. The applicant stated that this number of cycles will not be exceeded even if the licensing period is extended to 60 years, because to do so, the applicant would have to start the pumps approximately once every two days, which far exceeds actual and projected pump use at the plant. The applicant stated that, since the cycle limit for the flywheel will not be exceeded, the analysis for the flywheel remains valid for the period of extended operation.

4.7.1.2 Staff Evaluation

10 CFR 54.21(c)(1) requires applicants for license renewal to demonstrate that TLAAs for license renewal have been projected through the end of the period of extended operation for their facilities, remain valid for the period of extended operation, or demonstrate that the effects of aging that are applicable to the components evaluated by the TLAAs will be managed during the period of extended operation. PWR RCP flywheels are designed with rotors and discs that revolve at high speeds that can make the components susceptible to crack initiation and growth by fatigue, which is a time-dependent aging mechanism. The regions of the flywheels that are most susceptible to low-cycle fatigue are located at the corners of the locking mechanisms in the flywheel discs. These corners act as stress risers which make the corners more highly susceptible to the initiation and growth of cracking induced by fatigue.

The scope of Section X of the GALL Report, Volume 2, does not currently include recommended guidelines for performing TLAAs of fatigue crack growth analyses for PWR RCP flywheels. However, RG 1.14, Revision. 1, “Reactor Coolant Pump Flywheel Integrity,” dated August, 1975, provides acceptable guidelines for ensuring the structural integrity of RCP flywheels in PWR-designed nuclear plants1 against critical-fracture or fatigue-induced failures. The applicant did not initially provide its fatigue crack growth analyses for the GE-designed and ABB-designed RCP flywheels in the FCS LRA. The staff issued RAI 4.7.1-1 to request that the applicant provide its fatigue crack growth analyses for the GE-designed and ABB-designed RCP flywheels for staff review to demonstrate that the fatigue crack growth analyses for the GE-designed and ABB-designed RCP flywheels remain valid for the period of extended operation for FCS.

The applicant provided its response to RAI 4.7.1-1 by letter dated December 19, 2002. For the GE-design RCP flywheel, the applicant clarified that the details of the analysis are adequately summarized in Section 4.3.5 of the FCS USAR. For the ABB-design RCP flywheel, the applicant provided proprietary calculation FC06608 for staff review.

The staff’s evaluation of the TLAAs for fatigue-induced crack growth in the GE-designed RCP flywheels and the ABB-designed RCP flywheel is discussed below.

<u>General Electric Design (GE-design) RCP Flywheels</u>

The applicant’s fatigue crack growth analysis for the GE-design RCP flywheel is summarized in USAR Section 4.3.5. Staff review of USAR Section 4.3.5 indicates that the USAR section provides sufficient technical information to address the staff’s request in RAI 4.7.1-1, as it relates to the fatigue crack growth analysis for the GE-designed RCP flywheel. The fatigue crack growth analysis summarized in the USAR postulates the occurrence of a surface flaw that extends 0.5 inches from the corner of the flywheel keyway locking component for the limiting flywheel disc. The fatigue crack growth analysis is based on the number of startups of a GE-designed RCP from 0 to 120 percent operational overspeed. The analysis is therefore dependent on the number of accumulated RCP trips over the licensed period for the plant. The postulated flaw size represents the crack size that could exist in the flywheel disc and be detected in the flywheel discs during inservice inspections (ISI) of the disc. The USAR section indicates that based on a 17.5 ksi loading stress, which is attributed to rotation of the disc at 120 percent of the flywheel's normal operational design speed, it would take 185,000 trips of the RCP to extend the 0.5 inch flaw beyond the critical flaw size for the disc (i.e., 3.0 inches). This would require the applicant to trip the RCP associated with the GE-designed flywheel at a frequency exceeding eight pump trips per day. This frequency conservatively exceeds the number of anticipated GE-design RCP trips assumed in the design basis through the end of the period of extended operation for FCS.

ABB Design RCP Flywheel (ABB-design, flywheel for the RCP No. RC-3B)

In its response to RAI 4.7.1-1, by letter dated December 19, 2002, the applicant provided the fracture mechanics and fatigue crack growth analysis for the ABB-designed RCP flywheel. The ABB analysis postulates the existence of a fatigue-induced crack (the length is designated as proprietary information in the calculation) in the flywheel that is more than 30 percent of the acceptable crack length in the flywheel. The crack growth analysis is based on the stress intensity associated with the operating condition that creates the limiting applied stress (load) on the crack. The following loading (stress) conditions were considered:

- loading under normal operations with revolution of the flywheel at synchronous speed
- loading under normal operations with revolution of the flywheel at test speed (i.e., rotation at greater than 120 percent of synchronous speed)
- loading under operational basis earthquake loads with revolution of the flywheel at synchronous speed
- loading under design basis earthquake loads (faulted conditions) with revolution of the flywheel at synchronous speed

For FCS, this limiting applied stress is associated with revolution of the flywheel at synchronous speed under faulted loading conditions, which bound the loading conditions for revolution of the flywheel at test speed under normal operations. The applicant therefore based the loadings for the fatigue crack growth analysis on the loadings for revolution of the flywheel at synchronous speed under faulted loading conditions. This is a conservatism in the analysis. The staff's review of the applicant's proprietary analysis confirmed that it would take more than 10,000 trips of the RCP to exceed the maximum allowable crack size for the ABB-designed RCP flywheel. To achieve this number of pump trips, the applicant would have to trip the RCP associated with the ABB-designed flywheel at a frequency exceeding once every two days. This frequency exceeds the number of anticipated ABB-designed RCP trips assumed in the design basis through the end of the period of extended operation for FCS.

4.7.1.3 USAR Supplement

The applicant provides its USAR Supplement for the TLAAs on the GE-designed and ABB-designed RCP flywheels in Sections A.3.6.1.1 and A.3.6.1.2 of the LRA. The USAR Supplement summarized the fatigue crack growth analysis results and crack growth conclusions for the flywheels. The USAR Supplement also provides enough information to demonstrate that the structural integrity of the GE-designed and ABB-designed RCP flywheels will be acceptable through the expiration of the period of extended operation for FCS. Based on the staff's review of Sections A.3.6.1.1 and A.3.6.1.2 of the LRA, the staff concludes that the

USAR Supplement for the TLAAs on the GE-designed and ABB-designed RCP flywheels are acceptable and satisfy 10 CFR 54.21(d).

4.7.1.4 Conclusions

On the basis of its review, including the applicant's response to the staff's RAI, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1) that, for the fatigue crack growth TLAAs for GE-designed and ABB-designed RCP flywheels, and that the analyses remain valid for the period of extended operation for FCS. The staff also concludes that the USAR Supplement Sections A.3.6.1.1 and A.3.6.1.2 contain appropriate summary descriptions of the applicant's RCP flywheel fatigue TLAA evaluations for the period of extended operation, as required by 10 CFR 54.21(d). Therefore the staff finds that the safety margins established and maintained during the current operating term will be maintained for the period of extended operation.

4.7.2 Leak-Before-Break (LBB) Analysis for Resolution of USI A-2

4.7.2.1 Summary of Technical Information in the Application

In Section 4.7.2 of the applicant's LRA, the applicant states:

> There are two TLAA aspects to LBB, crack growth and thermal aging. While transient cycle fatigue crack growth is a TLAA for FCS and also a design consideration, thermal aging was not evaluated for FCS by either the original design code or the LBB analysis. Consequently, OPPD will perform a plant-specific LBB analysis prior to the period of extended operation. This analysis will consider a 60-year life and thermal aging effects of the cast austenitic stainless steel (CASS) RCS and will be completed before the period of extended operation. Therefore, the analysis will be projected to the end of the period of extended operation.

The staff requested an additional applicant commitment in RAI 4.7.2-1 regarding the evaluation of the impact of the potential for Inconel 82/182 weld PWSCC on the applicant's LBB evaluation. In response to RAI 4.7.2-1, the applicant stated

> "For the period of extended operation of FCS, OPPD will implement actions or perform analyses, as required by the NRC, to confirm continued applicability of existing FCS LBB evaluations. These actions or analyses will be consistent with those required to address the impact of PWSCC on existing LBB evaluations under Part 50 considerations."

4.7.2.2 Staff Evaluation

The staff has evaluated the information provided by the applicant in its LRA and in its response to RAI 4.7.2-1. The staff has concluded that the applicant appropriately identified those TLAAs (fatigue crack growth, aging of cast austenitic stainless steel (CASS) RCS piping and components, and primary water stress-corrosion cracking (PWSCC) of Inconel 82/182 RCS welds), which may impact the extension of the applicant's existing leak before break (LBB) analysis through the period of extended operation. The applicant has committed to perform a plant-specific LBB analysis prior to entering the period of extended operation which will address these TLAAs and project the analysis to the end of the period of extended operation. However, the applicant's commitment did not appear to meet 10 CFR 54.21(c)(1) which requires the applicant to demonstrate that (i) the analysis remains valid for the period of extended operation,

(ii) the analysis has been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff requested that the applicant provide the information needed for the staff to determine whether (i) the applicant's LBB analysis remains valid for the period of extended operation, (ii) the applicant's LBB analysis has been projected to the end of the period of extended operation, or (iii) the effects of aging on the intended function(s) of the components within the scope of the LBB analysis will be adequately managed for the period of extended operation. This was identified as Open Item 4.7.2.2-1.

NEI 95-10, Revision 3, provides guidance to applicants who apply for renewal of their operating licenses. In Regulatory Guide 1.188, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses," the staff has endorsed this NEI guideline. Section 5.1.4 of NEI 95-10 allows for deferral of TLAA evaluations. The guidance states that, if an applicant decides to defer the completion of an evaluation, it should submit additional information to the staff to support a conclusion that the effects of aging addressed in the TLAA will be adequately managed. This information includes (1) details of the methodology that will be used for the TLAA evaluation, (2) the acceptance criteria that will be used to judge the adequacy of the structure or component, consistent with the CLB, when the TLAA evaluation or analysis is performed, (3) the corrective actions that will be performed to provide reasonable assurance that the structure or component will perform its intended function or will not be outside of its design basis established by the CLB, and (4) information to identify when the completed TLAA evaluation will be submitted to ensure that the evaluation will be performed before the structure or component will be unable to perform its intended function.

By letter dated July 7, 2003, the applicant stated that it will defer completion of the plant-specific LBB evaluation in accordance with Section 5.1.4 of NEI 95-10. The applicant submitted the information below, as provided in NEI 95-10.

- The applicant committed to complete a plant-specific LBB evaluation of the RCS piping using the latest LBB criteria. The LBB analysis will incorporate the effects of thermal aging, plant-specific materials, operating temperatures/pressures, loads at welds in the primary loops, and weld fabrication. The plant-specific methodology will also use the existing plant's RCS leak detection capability and the piping stress analysis loads for the FCS RCS configuration. The analysis will be applicable for the period of extended operation, and will use a methodology from the Westinghouse Electric Company for thermal aging considerations. Westinghouse has performed over 30 plant-specific LBB analyses approved by the NRC, and addressed thermal aging effects of the cast materials as applicable. For the primary loop piping, the latest LBB SER which includes the Westinghouse analysis methodology was for D.C. Cook Units 1 and 2. This SER was issued in December 1999 (docket numbers 50-315 and 50-316).

The staff reviewed this information and finds that it adequately describes the methodology that will be used for the applicant's LBB analysis.

- Acceptance criteria used to determine the adequacy of the structure or component when the LBB analysis is performed will be in accordance with draft Standard Review Plan (SRP) 3.6.3, "Leak-Before-Break Evaluations Procedures," published for comment in Volume 52, Number 167 of the *Federal Register*, dated, Friday, August 28, 1987, and NUREG-1061, Volume 3.

The staff reviewed this information and finds that the applicant has identified the acceptance criteria that will be used to judge the adequacy of the structures or components when the LBB analysis is performed.

- The plant-specific LBB analysis will include evaluation of corrective actions that can be performed to provide reasonable assurance that the component in question will perform its intended function when called upon, or will not be outside of its design basis established by the plant's CLB. One such corrective action is to maintain the CLB RCS leak rate program as defined in FCS Technical Specification (TS) 2.1.4 during the period of extended operation. The leak detection capability of the systems noted in TS 2.1.4 meet the intent of Regulatory Guide 1.45 and will be capable of performing their designed function during the period of extended operation.

The staff reviewed this information and finds that the applicant has identified the corrective actions it will perform to ensure that the structures and components will continue to perform their intended functions.

- The applicant committed to submit a License Amendment Request containing the plant-specific LBB evaluation described above to the NRC no later than December 2006, which is well before the period of extended operation. This submittal schedule supports the applicant's planning decisions for possible changes to RCS operation or configuration.

The staff reviewed this information and finds that the applicant has identified the submittal date for the LBB analysis. Further, the staff concludes that this submittal date should provide sufficient time to address aging issues before loss of intended function of the applicable SCs.

On the basis of the applicant's response to Open Item 4.7.2.2-1, the staff concludes that the applicant has followed the guidance to support the deferral of the submittal of its LBB analysis. The characteristics of the LBB analysis, as proposed by the applicant, is sufficient to allow the staff to conclude that the effects of aging addressed in the TLAA will be adequately managed, as required by 10 CFR 54.21(c)(1)(iii). Open Item 4.7.2.2-1 is closed.

With regard to the identified fatigue crack growth and CASS thermal aging TLAAs, the staff has determined that adequate assurance exists regarding the ability of the applicant to perform acceptable analyses of these issues. Each of these issues has been adequately addressed by other license renewal applicants in support of extending existing LBB evaluations through the period of extended operation. The NRC staff has concluded that there are no known unique concerns regarding FCS which would prevent the applicant from performing acceptable TLAAs for each of these issues prior to entering the period of extended operation for FCS.

Regarding the impact of Inconel 82/182 PWSCC on LBB evaluations, the NRC staff has concluded that this is a generic current licensing basis issue outside of the scope of license renewal. The staff is continuing to review the generic implications of PWSCC on LBB approvals. The staff may consider the need for additional applicant actions or analyses, as appropriate, to ensure that the underlying basis for approval of LBB for the FCS main coolant loop remains valid. Therefore, the staff finds the applicant's commitment to "implement actions or perform analyses, as required by the NRC, to confirm continued applicability of existing FCS

LBB evaluations....consistent with those required to address the impact of PWSCC on existing LBB evaluations" (see the applicant's response to POI-7(f) in Section 3.1.2.3.4.2 of this SER) to be acceptable for addressing this TLAA within the scope of the applicant's LRA.

4.7.2.3 USAR Supplement

The applicant provides its USAR Supplement for the LBB analysis in Section A.3.6.2 of the LRA. On the basis of its review, the staff concludes that the USAR Supplement for the TLAAs on LBB is acceptable.

4.7.2.4 Conclusions

On the basis of its review, the staff concludes that the applicant will be able to provide, prior to entering the period of extended operation, an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), regarding the projection of its leak-before-break analysis for resolution of USI A-2 TLAA, through the end of the period of extended operation. The applicant's commitment to submit an updated LBB analysis, which addresses the TLAAs identified above, is documented in Appendix A to this SER. The staff also concludes that the USAR Supplement contains an appropriate summary description of the LBB analysis for resolution of USI A-2 TLAA evaluation for the period of extended operation, as required by 10 CFR 54.21(d). Therefore, the staff finds that the safety margins established and maintained during the current operating term will be maintained during the period of extended operation, as required by 10 CFR 54.21(c)(1).

4.7.3 High-Energy Line Break

4.7.3.1 Summary of Technical Information in the Application

The applicant described its evaluation of high-energy line breaks (HELBs) in Section 4.7.3 of the LRA. The applicant indicated that fatigue analyses were performed for the B31.7 Class I portions of main steam (MS) and main feedwater (MFW) outside containment to identify locations with CUF greater than 0.1, which is the criterion for postulating pipe breaks. The applicant indicated that, for the MFW piping, breaks were postulated at the end of each pipe segment. The applicant indicated that the Class I portions of the MFW outside containment are wrapped in steel "barrel slat" enclosures to prevent lateral pipe movement and the formation of longitudinal and axial jets, which could impact nearby structures and equipment. The applicant further indicated that pipe whip restraints are installed to limit pipe movement due to circumferential breaks. Consequently, the applicant concluded that any additional locations on the Class I portion of the piping will be bounded by the existing break locations. The applicant indicated that a similar design existed for the Class I MS piping with one potential exception. The applicant indicated that an evaluation had not been performed to determine whether the slat enclosures protected the piping connections to the isolation valves. The applicant indicated that the design CUFs at these locations were less than 0.001 and, therefore, would not exceed the 0.1 criterion during the period of extended operation.

4.7.3.2 Staff Evaluation

The applicant's HELB criteria are provided in Appendix M of the USAR. Appendix M indicates that portions of the MS and MFW piping between the containment and the outside isolation valve were designed in accordance with ANSI B31.7. The Class I criteria require a fatigue analysis. As indicated by the applicant, the pipe break criteria for the Class I portions of the MS and MFW piping require postulation of pipe breaks at locations where the CUF may exceed 0.1. The applicant's evaluation indicates that the existing postulated pipe breaks are bounding for all Class I sections of the MS and MFW piping, except the MS connections to the isolation valves. The applicant's evaluation also indicates that the calculated usage factor for those locations will not exceed the criterion of 0.1 for the period of extended operation. Therefore, the applicant concluded that the pipe break analyses remain valid for the period of extended operation and meet the requirements of 10 CFR 54.21(c)(1)(i). The staff finds that the applicant performed an acceptable TLAA of the FCS pipe break criteria.

The staff also reviewed the USAR Supplement for this TLAA and concludes that it provides an adequate summary description of the TLAA to satisfy 10 CFR 54.21(d).

4.7.3.3 Conclusions

On the basis of its review, the staff concludes that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), that for the HELB TLAA, the analyses remain valid for the period of extended operation. The staff also concludes that the USAR Supplement contains an appropriate summary description of the HELB TLAA evaluation for the period of extended operation, as required by 10 CFR 54.21(d). Therefore the staff finds that the safety margins established and maintained during the current operating term will be maintained during the period of extended operation.

4.7.4 Alloy 600 Weld Repair in a Temperature Nozzle in the Pressurizer Lower Shell

4.7.4.1 Summary of Technical Information in the Application

The application did not initially discuss an Alloy 600 repair in the temperature nozzle in the pressurizer lower shell. As a result of discussions between the staff and the applicant, the applicant in a letter dated July 7, 2003, added a new Section 4.7.4 to the license renewal application. This section indicates that the temperature nozzle in the pressurizer lower shell was repaired by adding a weld pad to the existing weld build-up to the lower shell outer diameter (OD) and welding this pad to the existing nozzle. This moved the pressure boundary from the inner diameter to this location. The Alloy 600 J-weld and original crack were left in place at the inside surface of the pressurizer as part of the repaired configuration.

In a letter dated October 25, 2000, Westinghouse provided Omaha Public Power District (OPPD) the technical justification for the weld on the liquid space Alloy 600 instrument nozzle on the OD of the pressurizer. This letter stated that the subject repair should be made in accordance with later editions of Section III, or the 1992 Edition (or later) of Section XI.

In April 2002, Westinghouse notified OPPD that its technical justification of October 2000 only considered the effects of the repair on the requirements of ASME Section III, and did not consider the Section XI requirements related to leaving the flaw in place after the repair was completed and the vessel returned to service.

In April 2003, OPPD received the "calculation note" titled "Evaluation of Fatigue Crack Growth of Postulated Flaw at Omaha Fort Calhoun Pressurizer Lower Shell Instrumentation Nozzle," dated January 8, 2003, that evaluated the Section XI requirements related to leaving the flaw in place after the repair was completed and the vessel returned to service.

OPPD has evaluated the crack, and any potential future growth of the crack, and determined it does not impact the structural integrity of the vessel for the current licensed 40-year life. OPPD has elected to defer completion of the evaluation that demonstrates that the crack and any potential future growth of the crack does not impact the structural integrity of the vessel for the period of extended operation. On the basis of guidance in Section 5.1.4 of NEI 95-10, Revision 3, the applicant provided details to explain how the effects of aging will be addressed for this evaluation.

OPPD will submit, for staff review and approval, the fracture mechanics evaluation for the period of extended operation of the small-bore instrument nozzle J-weld region at the repaired instrument nozzle. This submittal will be made prior to entering the period of extended operation. This evaluation will include bounding the flaw size by the size of the J-weld itself, and addressing the possibility of corrosion in the presence of a flaw.

4.7.4.2 Staff Evauation

Because the application did not initially discuss an Alloy 600 repair in the temperature nozzle in the pressurizer lower shell, the staff identified the resolution of this issue as Open Item 4.7.4-1.

10 CFR 54.3 contains six criteria that must be satisfied for an analysis to be considered a time-limited aging analysis (TLAA). As a result of the information submitted in their July 7, 2003 letter, the evaluation of flaw growth for a crack that was left in place at the inside surface of the pressurizer and the impact of corrosion on the pressurizer nozzle meet these six criteria and should be considered a TLAA.

Section 5.1.4 of NEI 95-10, Revision 3 indicates that an applicant who elects to defer completing the evaluation of a TLAA at the time of a renewal application should submit the following details in the renewal application to support a conclusion that the effects of aging addressed by that TLAA will be managed for a specific structure or component:

1. Details concerning the methodology which will be used for TLAA evaluation,

2. Acceptance criteria that will be used to judge the adequacy of the structure or component, consistent with the CLB, when the TLAA evaluation or analysis is performed,

3. Corrective actions that the applicant could perform to provide reasonable assurance that the component in question will perform its intended function when called upon or will not be outside of its design basis established by the plant's CLB, and

4. Identification of when the completed TLAA evaluation will be submitted to ensure that the necessary evaluation will be performed before the structure of component in question would not be able to perform its intended functions established by the CLB.

The July 7, 2003 letter contains a methodology and criteria for evaluating the impact of flaw growth on the original crack that was left in place at the inside surface of the pressurizer and specifies that the impact of corrosion will be included in the evaluation. The methodology is summarized as follows:

1. Design drawings are reviewed to determine vessel, nozzle and J-weld dimensions and materials.

2. The initial flaw size to be used in the evaluation is calculated.

3. Manufacturing records are reviewed to determine the reference temperature (RT_{NDT}) of the base metal at the location of interest.

4. Design operation transients are reviewed to determine their appropriateness for use in the generation of stresses for use in the flaw analysis.

5. When the design transients are not appropriate, a realistic bounding transient is developed for analysis purposes.

6. Thermal transient analyses are performed to determine through-wall temperatures for use in the stress analysis.

7. Stress analyses are performed at various time points during each plant operating event of interest.

8. Pressure and mechanical load stresses are calculated.

9. A survey of the combined pressure, thermal and mechanical stresses is conducted to determine the limiting time point for evaluation.

10. Stresses are determined to calculate the applied stress intensity factor, K_I.

11. The applied stress intensity factor is calculated for comparison to allowable values.

12. Fatigue crack growth of the flaw is calculated over the 60 years.

13. The final flaw size is used to confirm flaw stability over the remaining life of the plant.

14. The flaw stability checks defined above are performed for normal and upset conditions and emergency and faulted conditions using the respective allowables defined per ASME Section XI.

15. Primary stress limits per NB-3000 are checked considering the effect of the final flaw size.

This methodology is acceptable because it will determine the impact of plant operation, design transients, material fracture resistance, and flaw growth on pressurizer integrity for the period of extended operation.

The flaw will be acceptable if it satisfies the linear elastic fracture mechanics criteria in ASME Code Section XI, IWB-3611 or IWB-3612, or elastic-plastic fracture mechanics criteria in ASME

Code Section XI, Appendix K, articles K-2200, K-2300, and K-2400. Since the acceptance criteria are in accordance with ASME Code criteria, they are acceptable for use in this TLAA.

The applicant's corrective action includes assuring that the pressure at any temperature should not be any higher than the higher of the following two limits:

1. The saturation pressure plus 200 psi, and

2. 350 psi and the maximum rate of temperature decrease is 200 °F/hr.

By limiting pressure and the maximum rate of decrease in temperature for the pressurizer, the corrective action will limit the stresses on the flaw remaining in the pressurizer and provides reasonable assurance that the component in question will perform its intended function when called upon or will not be outside of the design basis established by the plant's CLB.

The applicant indicates that the TLAA for this issue will be completed before the period of extended operation and the analyses will be submitted for staff review and approval.

By satisfying the criteria in Section 5.1.4 of NEI 95-10, Revision 3, the staff concludes that the applicant has provided a methodology and criteria for assuring that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation and has satisfied the TLAA criteria 10 CFR 54.21(c)(1)(iii). The applicant's commitment to complete the evaluation is documented in Appendix A of this SER.

On the basis of the staff's evaluation described above, the summary description for the "Pressurizer Alloy 600 J-Weld Left in Place" described in the USAR Supplement (LRA, Appendix A.3.6.4) is acceptable. Open Item 4.7.4-1 is closed.

4.7.4.3 Conclusions

The staff has reviewed the information provided regarding the TLAA for the Alloy 600 repair in the temperature nozzle in the pressurizer lower shell. On the basis of this evaluation and the licensee's commitment to complete and submit the evaluation of the small-bore instrument nozzle J-weld region at the repaired instrument nozzle to the NRC before the period of extended operation, the staff concludes that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation and has satisfied the TLAA criteria 10 CFR 54.21(c)(1)(iii).

In addition, the staff concludes that the applicant's USAR Supplement provides an adequate description of the analysis to be performed to evaluate the pressurizer Alloy 600 J-Weld left in place, as required by 10 CFR 54.21(d).

4.8 Evaluation Findings

The staff has reviewed the information in Section 4 of the LRA. On the basis of its review, the staff concludes that the applicant has provided an adequate list of TLAAs, as defined in 10 CFR 54.3. Further, the staff concludes that the applicant has demonstrated or will demonstrate that the TLAAs (1) will remain valid for the period of extended operation, as required by 10 CFR 54.21(c)(1)(i); (2) have been projected to the end of the period of extended operation, as required by 10 CFR 54.21(c)(1)(ii); or (3) the aging effects will be adequately managed for the period of extended operation, as required by 10 CFR 54.21(c)(1)(iii). In addition, the staff concludes that there are no plant-specific exemptions in effect that are based on TLAAs, as required by 10 CFR 54.21(c)(2). Finally, the staff has reviewed the USAR Supplements and concludes that the applicant has provided or will provide adequate descriptions of the TLAAs credited for license renewal, as required by 10 CFR 54.21(d).

On this basis, the staff finds that the aging effects associated with the structures and components subject to TLAAs are addressed such that the structures and components will perform their intended functions in accordance with the current licensing basis during the period of extended operation, as required by 10 CFR 54.21(a)(3).

5 REVIEW BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

The Advisory Committee on Reactor Safeguards (ACRS) will review the 10 CFR Part 54 portion of the Fort Calhoun Station, Unit 1 (FCS) license renewal application (LRA). The Omaha Public Power District and the staff will meet with the ACRS full committee to discuss issues associated with the review of the LRA.

After the ACRS completes its review of the FCS LRA and SER, the full committee will issue a report discussing the results of its review. This ACRS report will be included in an update to this SER. The staff will address any issues and concerns identified in that report.

6 CONCLUSIONS

The staff reviewed the Fort Calhoun Station, Unit 1, license renewal application in accordance with Commission regulations and NUREG-1800, “Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants,” dated July, 2001. In accordance with 10 CFR 54.29, the staff identifies the standards for issuance of a renewed license.

On the basis of its evaluation of the application as discussed above, the staff has determined that the requirements of 10 CFR 54.29 have been met.

The staff notes the requirements of Subpart A of 10 CFR Part 51 are documented in NUREG-1427, Supplement 12, “Generic Environmental Impact Statement for License Renewal of Nuclear Plants,” dated August 15, 2003.

Appendix A: Commitment Listing

During the review of the FCS LRA by the NRC staff, the applicant made commitments to provide aging management programs to manage aging effects of structures and components prior to the period of extended operation, as well as other information. The following table lists these commitments, along with the implementation schedule and the source of the commitment.

ITEM NUMBER	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE
	Alloy 600 Program		
1	The Alloy 600 Program is a new program at FCS. With this being the case, inspection methodologies for all of the components in the program have not yet been determined. Some of the components that are in the program are currently part of other programs like the reactor vessel internals inspection program. The activities that occur under the interfacing programs relative to these components will be utilized to help analyze and determine the methodologies to be incorporated within the Alloy 600 program for inspection of its included components. These analyses and determinations will be completed prior to entry into the period of extended operation.	Prior to the period of extended operation	Response to RAI 3.1.1-3
2	There is to be a plant-specific program, the Alloy 600 program, for the aging management of Inconel 182 welds. The details of this program are still in development but will be completed prior to the period of extended operation.	Prior to the period of extended operation	Response to RAI 3.1.2-4

3	The flow skirt is one of those components currently included under the scope of the reactor vessel internals inspection program and the Alloy 600 program. Exactly how the flow skirt is to be managed under the Alloy 600 program is yet to be determined; however, that determination will be made before entry into the period of extended operation.	Prior to the period of extended operation.	Response to RAI 3.1.2-3
4	Develop the Alloy 600 program which reflects the program elements of GALL AMP XI.M11, and other commitments in response to the NRC staff's review. An assessment of Alloy 600 and Alloy 82/182 components has been performed and incorporated into the Alloy 600 program basis document. The assessment … provided conclusions and recommendations to address the specified components...These recommendations will be evaluated as part of the Alloy 600 program and implemented as necessary to ensure the reliability of the Alloy 600 and Alloy 82/182 components. The applicant will incorporate appropriate information from its responses to GL 97-01 and NRC Bulletins 2001-01, 2002-01, and 2002-02.	Prior to the period of extended operation.	LRA Section B.3.1 and responses to RAIs B.3.1-1(2) and B.3.1-1(3)

5	OPPD's response to RAI B.3.1-1 also states that the FCS Alloy 600 Program currently includes a requirement to monitor industry operating experience and implement program enhancements as necessary. By making this a requirement of the Alloy 600 Program, OPPD has committed to incorporating industry activity recommendations or mandates as applicable.	Prior to the period of extended operation	Response to POI-7(f)
	Inservice Inspection Program		

6	OPPD commits to applying recommended or mandated activities resulting from the CRD Material Reliability Management Plan with regard to management of CEDM housings. OPPD will submit the revised AMPs prior to the period of extended operation to ensure that the revised AMPs are adequate to manage the aging of the CEDM housings.	Prior to the period of extended operation	Responses to RAI 3.1.1-4 and POI-8(f)
	One-time Inspection Program		

7	Develop the one-time inspection program which reflects the program elements of GALL AMP XI.M32, and other commitments in response to the NRC staff's review, as documented in responses to staff RAIs and potential open items (POIs).	Prior to the period of extended operation.	LRA Section B.3.5, as reflected in RAI and POI responses
8	OPPD has conservatively included loss of material as an AERM for Alloy 600 in borated treated water…To validate the effectiveness of the chemistry program, OPPD will determine the worst-case location for the potential occurrence of this AERM and perform a one-time inspection of this location prior to the period of extended operation.	Prior to the period of extended operation	Response to RAI 3.1.2-5 and POI-8(d)
9	OPPD will continue to visually inspect and perform a dye-penetrant exam on the two remaining RCP thermal barriers when the rotating assemblies are refurbished. In addition, an air drop test will also be performed on the seal water coolers to ensure tube integrity. FCS will credit the One-Time Inspection Program for these RCP thermal barrier and seal water cooler tubes.	Prior to the period of extended operation	Response to RAI 3.1.2-1 and Open Item 3.0-1
10	OPPD commits to the requirements in GALL report Section XI.M32 relative to the inspection of small-bore RCS piping and to base inspections on those locations where small-bore piping is subject to thermal cycling stratification and turbulent penetration	Prior to the period of extended operation	Response to POI-8(e)
11	Worst-case locations will be evaluated and identified, taking into account severity of condition, time of service, and lowest design margin, as part of the implementation of the one-time inspection program (B.3.5) prior to the period of extended operation.	Prior to the period of extended operation	Response to RAI 3.4.1-11

	Diesel Fuel Monitoring and Storage Program		
12	New fuel additions to the fire protection diesel fuel oil tank will be analyzed for water and sediment, and this water and sediment will be removed, to preclude water contamination, and the tank bottom will be monitored to ensure water or biological activity is not accumulating. UT and/or visual inspections will be performed in the other storage tanks which credit this program for aging management. The low point beyond the main tank is the bottom of the day tank, and a day tank sample will be drawn from the bottom of the tank and analyzed for water and sediment. OPPD commits to performance of a one-time inspection... to determine the condition of the fire protection fuel oil tank and verify that the tank is not in a degraded condition.	Ongoing, beginning prior to the period of extended operation	LRA Section B.2.3 and responses to RAI B.2.3-1 and POI-7(c)
13	The fire protection day tank will be analyzed quarterly for water and sediment, semi-annually for microbiological activity, and will have a one-time boroscope inspection performed.	Tank analysis - ongoing, beginning prior to the period of extended operation. Boroscope inspection - prior to the period of extended operation	Response to RAI B.2.3-2
	Fire Protection Program		

14	Additional guidance will be added to the diesel fire pump maintenance procedure to inspect the diesel fire pump fuel line and zinc plug for corrosion or mechanical damage. Specific guidance will be added to the halon and fire damper inspection procedures to inspect halon system components and fire dampers for corrosion, and mechanical and physical damage. Specific acceptance criteria will be added to the fire barrier inspection procedures for concrete walls, floors, and ceilings. Specific guidance will be added to the fire door inspection procedure to inspect for wear and missing parts. Specific guidance will be developed to replace or inspect in-scope sprinkler heads in accordance with NFPA-25. Additional guidance will be added to one of the system valve cycling tests to improve system flushing. Specific guidance will be developed for flow testing the in-scope sprinkler system.	Prior to the period of extended operation	LRA Section B.2.5

15	Enhancements will be made to the Fire Protection Program prior to the period of extended operation to implement the requirements of the interim staff guidance (on wall thinning of piping due to corrosion).	Prior to the period of extended operation	Response to RAI B.2.5-2

	Reactor Vessel Internals Inspection Program		
16	Visual inspections of the core shrouds at Palisades and FCS in 1995 and 1993, respectively, revealed no panel separation and no missing bolts. Ten-year in-service inspections were performed at FCS in 1992 and will be performed again in 2003 and prior to the period of extended operation. The results of these inspections, the Palisades in-service inspection results, and the results of industry programs will be monitored to determine if additional action, such as ultrasonic inspection, is necessary. The EPRI MRP is developing an action plan to address potential SCC of reactor vessel internals. OPPD is participating in this program and will take action, as necessary, in response to any recommendations and findings coming from the evaluation.	10-year inspection of core shroud - ongoing beginning prior to the period of extended operation. Implementation of EPRI MRP recommendations - when recommendations are available	Response to RAI B.2.8-1
17	OPPD has incorporated an augmented inspection of the thermal shield bolting or pins within the Reactor Vessel Internals Inspection Program...OPPD continues to monitor thermal shield vibrations as a task within the Reactor Vessel Internals Inspection Program (B.2.8).	Ongoing	Response to RAI 3.1.3-1

18	The following enhancements will be made to the Reactor Vessel Internals Inspection Program: A fluence and stress analysis will be performed to identify critical locations. A fracture mechanics analysis for critical locations will be performed to determine flaw acceptance criteria and resolution required to detect flaws. Appropriate inspection techniques will be implemented based on analyses. (For the RVI flow skirt)The fracture mechanics analysis committed to in Section B.2.8 of the LRA will be performed.	Prior to the period of extended operation.	LRA Section B.2.8 and response to RAI 3.1.2-3

	Buried Surfaces External Corrosion Program		
19	As identified in the FCS License Renewal Application, the Buried Surfaces External Corrosion Program is a new program that will be implemented at FCS prior to the period of extended operation. The new program will include the following items to make it consistent with GALL XI.M34, "Buried Piping and Tanks Inspection" criteria: • A revision has been completed to the FCS maintenance control procedure to require engineering evaluation of concrete, piping, and piping coatings whenever excavations are performed. • Current routine inspections of diesel fuel oil tanks within the scope of license renewal will be annotated as commitments required to meet license renewal requirements. • A program basis document will be developed which will define the program requirements and compile industry and FCS operating experience related to buried components.	Prior to the period of extended operation.	Response to RAI B.3.2-1
	General Corrosion of External Surfaces Program		
20	Procedures will be revised to include acceptance criteria that a visual indication of loss of material or cracking of elastomer ventilation components identified by the accountable Operator or Engineer will not necessarily lead to an unacceptable component.	Prior to the period of extended operation.	Response to RAI B.3.3-5

	Boric Acid Corrosion Prevention Program		
21	Specific guidance will be added to the program basis document and applicable procedures to inspect components, structures, and electrical components where boric acid may have leaked. Add Spent Fuel Pool Cooling and Waste Disposal Systems to the program. Two areas not routinely inspected will be added to inspection scope. Specific guidance will be implemented for maintenance personnel to report boric acid leakage to the BAC Program Engineer.	Prior to the period of extended operation.	LRA Section B.2.1
	Cooling Water Corrosion Program		
22	Inspections to various raw water and cooling water components will be added based on FCS' Cooling Water Corrosion Program susceptibility evaluation. These inspection activities will be commensurate with the GALL Program.	Prior to the period of extended operation.	LRA Section B.2.2
	Fatigue Monitoring Program		

23	Add the following to the scope of components subject to the FCS Fatigue Monitoring Program: Pressurizer Surge Line bounding locations, and elbow Class 2 and 3 components not included in the NUREG-1801 program which are subject to fatigue as an aging effect requiring management. The number of cycles assumed for the evaluation of the charging line nozzle will be included in the Fatigue Monitoring Program Basis Document, when it is generated, to assure that a CUF of 1.0 is not exceeded.	Prior to the period of extended operation.	LRA Section B.2.4 and response to POI-13(e)
24	Cycles which involve power changes, operating pressure and temperature variations, and feedwater additions with the plant in hot standby conditions will be conservatively estimated from a review of plant operating records to predict current cycles under the FMP. Once current number of cycles has been established, a review will be performed to determine if there is a potential for exceeding the allowable cycles and should be managed. If so, they'll be counted and managed by the FMP.	Review to be completed prior to the period of extended operation	Response to RAI 4.3.1-1

25	The limiting surge line welds will be inspected prior to the period of extended operation. The results of these inspections will be used to assess the appropriate approach for addressing environmentally-assisted fatigue of the surge lines. The approach would include one or more of the following options: 1. further refinement of the fatigue analysis to lower the CUF(s) to below 1.0 2. repair of the affected locations 3. replacement of the affected locations 4. management of the effects of fatigue by an inspection program that has been reviewed and approved by the NRC (e.g., periodic nondestructive examination of the affected locations at inspection intervals to be determined by a method accepted by the NRC)	Prior to the period of extended operation	Response to POI-13(d) and RAI 4.3.2-3
26	As part of the FMP, the NSSS sampling piping will be analyzed and a stress calculation performed to determine the thermal stress range for the line.	Prior to the period of extended operation	Response to RAI 4.3.4-1
27	These CVCS cycle counts (loss of charging, intermittent manual charging makeup cycles, and maximum purification/emergency boration cycles) are gross estimates due to incomplete logs. …A condition report (CR) is being generated to address this issue within the corrective action program so that a more accurate transient count/determination can be performed for the indicated transients prior to entry into the period of extended operation.	Prior to the period of extended operation	Response to POI-13(c)

	Overhead Load Handling Systems Inspection Program		
28	Specific guidance will be added to applicable inspection procedures to inspect for degradation of expansion anchors and surrounding concrete. Specific guidance will be added to applicable inspection procedures to identify acceptance criteria for general corrosion and degradation of expansion anchors and surrounding concrete. Specific guidance will be added to applicable inspection procedures to initiate FCS corrective action documentation if excessive general corrosion or cracking of concrete around expansion anchors is identified.	Prior to the period of extended operation.	LRA Section B.2.6
	Containment ISI/Structures Monitoring Programs		
29	For concrete at FCS, even though OPPD has concluded that the AERMs identified for concrete in the GALL Report are not applicable due to the plant's operating experience, OPPD has committed to be consistent with the GALL Report and monitor for the possibility of the AERMs with the programs identified in the GALL Report.	Ongoing, beginning prior to the period of extended operation	Response to RAI 3.5-1

30	A periodic task will be initiated as part of the structures monitoring program to take ground water samples on a five year frequency and compare the evaluation results to previous samples.	Prior to the period of extended operation and ongoing thereafter at the stated frequency	Response to RAI 3.5.1-8
31	OPPD will perform a one-time inspection of the circulating water discharge tunnel per the structures monitoring program (B.2.10). The circulating water discharge tunnel will be included within the scope of license renewal as part of the intake structure.	Prior to the period of extended operation	Response to POI-3(a)

32	The following FCS-specific tasks will be added to the SMP: Performance of periodic sampling and evaluation of ground water. Guidance to inspect structural components when exposed by excavation. XI.S5 Specific guidance will be added to inspect masonry walls for cracking and condition of steel bracing. Specific acceptance criteria will be added to inspection procedures to be commensurate with industry codes, standards, and guidelines. XI.S6 Specific guidance will be added for inspection of component supports, new fuel storage rack, and the plant-specific components identified in the LRA Section 3 tables. Aging management activities related to these components will be commensurate with industry standards and practices as identified in the NUREG-1801 Structures Monitoring Program criteria. Additional guidance commensurate with industry codes, standards, and guidelines, will be added to inspection procedures.	Prior to the period of extended operation.	LRA Section B.2.10

32 (Con't)	Specific acceptance criteria will be added to the inspection procedures to be commensurate with industry codes, standards, and guidelines. XI.S7 Additional guidance will be added to the inspection procedure to identify specific parameters to inspect. Additional guidance will be added to review maintenance activities since last inspection. Specific acceptance criteria will be added to the inspection procedures to be commensurate with industry codes, standards, and guidelines.	Prior to the period of extended operation.	LRA Section B.2.10
	Selective Leaching Program		
33	Develop the selective leaching program which reflects the program elements of GALL AMP XI.M33, as clarified in LRA Section B.3.6, and other commitments in response to the NRC staff's review, as documented in the responses to staff RAIs and potential open items (POIs)	Prior to the period of extended operation.	LRA Section B.3.6, as reflected in the RAI responses, and POI responses
	Thermal Aging Embrittlement of CASS Program		
34	Develop the thermal aging embittlement of CASS program which reflects the program elements of GALL AMP XI.M12, and other commitments in response to the NRC staff's review, as documented in the responses to staff RAIs and potential open items (POIs)	Prior to the period of extended operation.	LRA Section B.3.7, as reflected in the RAI responses and POI responses
	Non-EQ Cable Aging Management Program		

35	For non-EQ cables and connections within the scope of license renewal and subject to an aging management review: OPPD will implement a program and inspection consistent with that described in XI.E1 of the GALL Report. OPPD will implement a program and inspection consistent with that described in XI.E2 of the GALL Report. OPPD will implement a program and inspection consistent with that described in XI.E3 of the GALL.	Prior to the period of extended operation.	LRA Section B.3.4 and responses to RAI B.3.4-1
	Periodic Surveillance and Preventative Maintenance Program		
36	The aging effects of hardening and loss of strength for elastomers are not included in the general corrosion of external surfaces program (B.3.3). Enhancements will be made to add these AERMs to preventive maintenance tasks under the PS/PMP (B.2.7) to specifically perform hands on type inspections of elastomer expansion joints, seals, and vibration isolators within the scope of license renewal for hardening and loss of strength. Applicable PMs are performed at least once per refueling cycle (approximately 18 months).	Prior to the period of extended operation	Response to RAI 3.3.1-1

37	The portion of CCW that provides cooling to the SI leakage coolers is included within the scope of license renewal. The piping and components will be added to the license renewal database and the CCW AMR evaluation will be revised to include these components.	Prior to the period of extended operation	Response to POI-3(b)
38	For commitments listed in the Safety Evaluation Report, OPPD will include this list of commitments in an appropriate subsection of the FCS USAR Supplement for License Renewal	Prior to the period of extended operation	Response to POI-13(d)
39	OPPD will complete a plant-specific leak before break (LBB) analysis using the latest LBB criteria. OPPD will submit to the NRC a license amendment request containing the plant-specific LBB evaluation	No later than December, 2006	Response to Open Item 4.7.2.2-1
40	OPPD will submit to the NRC a license amendment request containing the fracture mechanics evaluation of the small-bore instrument nozzle J-weld region at the repaired instrument nozzle in the side of the pressurizer lower shell. This evaluation will include bounding of the flaw size by the size of the j-weld itself, and addressing the possibility of corrosion in the presence of a flaw	Prior to the period of extended operation	Response to Open Item 4.7.4-1
41	OPPD will manage the aging of fuse holders in accordance with ISG-5	Ongoing, beginning prior to the period of extended operation	Response to Open Item 3.6.2.4.5.2-1

APPENDIX B

CHRONOLOGY

This appendix contains a chronological listing of routine licensing correspondence between the U.S. Nuclear Regulatory Commission (NRC) staff and the Omaha Public Power District (OPPD) regarding the NRC staff's safety review of the Fort Calhoun Station, Unit 1, application for license renewal (Docket No. 50-285).

January 9, 2002	FCS Application for Renewed Operating License
January 9, 2002	Transmittal of Boundary Drawings
February 6, 2002	Receipt and Availability of the FCS LRA
March 14, 2002	Status Letter on Acceptability Review
April 5, 2002	Supplemental LRA Information
April 16, 2002	LRA Acceptance Letter
August 22, 2002	Request for Partial Fee Waiver
August 23, 2002	Telecon Summary (conducted on August 7, 2002) - LRA Sections 2.3.3.5, 2.3.3.8, and 2.3.3.9
August 26, 2002	Revised Review Schedule
October 11, 2002	Transmittal of Staff Requests for Additional Information
November 22, 2002	RAI Response Letter (first of three)
November 22, 2002	Boundary Drawings to Support First RAI Response Letter
November 25, 2002	Revised Review Schedule
December 12, 2002	RAI Response Letter (second of three)
December 12, 2002	Boundary Drawings to Support Second RAI Response Letter
December 19, 2002	RAI Response Letter (third of three)
December 19, 2002	Boundary Drawings to Support Second RAI Response Letter
December 20, 2002	Scoping and Screening Inspection Report

January 16, 2003	Telecon Summary (conducted on July 18, 2002 and September 5, 2002) - LRA Sections 2.1.4, 2.2, 2.3.3.14, 2.3.3.19, 2.3.3.20, 2.3.4, B.3.2, and B.3.3
January 31, 2003	Granting of Partial Fee Waiver
February 20, 2003	Potential Open Item Letter
March 14, 2003	Responses to Potential Open Items
March 14, 2003	Telecon Summary (conducted on August 8, 2002) - LRA Sections 2.3.3.2, 2.3.3.15, and 2.3.3.16
April 4, 2003	Revised Responses to Potential Open Items
April 10, 2003	Telecon Summary (conducted on August 8, 2002) - LRA Sections 2.3.1.2, 2.3.1.3, 2.3.2.1, 2.3.3.3, 2.3.3.4, 2.3.3.6, 2.3.3.7, B.1.2, B.1.5, B.2.1, and B.3.6
April 12, 2003	Telecon Summary (conducted on September 19, 2002) - LRA Sections 4.7.1 and 4.7.2
April 17, 2003	Telecon Summary (conducted on September 16 and 17, 2002) - LRA Sections 2.5, 3.6, and B.3.4
May 2, 2003	Telecon Summary (conducted on March 18, 2003) - Potential Open Items 1(c), 6(a), 6(b), and 12
May 16, 2003	Fort Calhoun Station, Unit 1 Annual Update to Application for Renewed Operating License
June 13, 2003	Telecon Summary (conducted on June 6, 2003) - Open Item 3.6.2.4.3.2-1
July 7, 2003	License Renewal Safety Evaluation Report for Fort Calhoun Station Unit 1- Comments and Responses to Open and Confirmatory Items
August 7, 2003	License Renewal Safety Evaluation Report for Fort Calhoun Station Unit 1- Clarification of Responses to Open Items
	Meeting Summary (conducted on November 20 and 21, 2002) - LRA Sections 2.1, 2.1.4, 2.3.1.2, 2.3.2.1, 2.3.3.20, 2.3.3.5, 2.3.3.3, 2.3.3.15, 2.3.3.16, 2.3.4, 2.4.1, 2.4.2, 2.4.2.5, 2.4.2.6, 2.5, 3.1, 3.2, 3.6, 4.2, 4.7.1, B.1.7, B.2.9, B.3.1, B.3.2, and B.3.3
	Meeting Summary (conducted December 3 and 4, 2003) - LRA Sections 2.3.3.19, 2.3.3.20, 3.3, 3.4, 3.5, 4.1, 4.3, 4.5, 4.6, B.1.3, B.1.4, B.1.7, B.2.3, B.2.4, and B.2.5

August 28, 2003	Meeting Summary (conducted on May 28 and 29, 2003) - Open Item 3.0-1
September 5, 2003	Telecon Summary (conducted on May 8, 2003) - Open Items 3.6.2.3.1.2-1, 3.6.2.4.3.2-1, 3.6.2.4.4.2-1, and 3.6.2.4.5.2-1

APPENDIX C

REQUESTS FOR ADDITIONAL INFORMATION

RAI	ISSUANCE DATE	RESPONSE DATE	SUBJECT
2.1-1	October 11, 2002	December 19, 2002	Scoping and Screening Methodology
2.1-2	October 11, 2002	December 19, 2002	Scoping and Screening Methodology
2.1-3	October 11, 2002	December 19, 2002	Scoping and Screening Methodology
2.1.4-1	October 11, 2002	December 19, 2002	Scoping and Screening Methodology
2.2-1	October 11, 2002	November 22, 2002	Plant-Level Scoping Results
2.2-2	October 11, 2002	November 22, 2002	Plant-Level Scoping Results
2.2-3	October 11, 2002	December 19, 2002	Plant-Level Scoping Results
2.3.1.2-1	October 11, 2002	December 19, 2002	Reactor Coolant System
2.3.1.2-2	October 11, 2002	December 19, 2002	Reactor Coolant System
2.3.1.2-3	October 11, 2002	December 19, 2002	Reactor Coolant System
2.3.1.3-1	October 11, 2002	December 19, 2002	Reactor Vessel
2.3.2.1-1	October 11, 2002	December 19, 2002	Safety Injection and Containment Spray
2.3.3-1	October 11, 2002	December 19, 2002	Auxiliary Systems
2.3.3.1-1	October 11, 2002	December 19, 2002	Chemical and Volume Control

2.3.3.2-1	October 11, 2002	November 22, 2002	Spent Fuel Pool Cooling
2.3.3.2-2	October 11, 2002	December 12, 2002	Spent Fuel Pool Cooling
2.3.3.3-1	October 11, 2002	December 19, 2002	Emergency Diesel Generators
2.3.3.3-2	October 11, 2002	December 19, 2002	Emergency Diesel Generators
2.3.3.4-1	October 11, 2002	December 19, 2002	Diesel Generator Lube Oil and Fuel Oil
2.3.3.5-1	October 11, 2002	November 22, 2002	Auxiliary Boiler Fuel Oil and Fire Protection Fuel Oil
2.3.3.5-2	October 11, 2002	December 19, 2002	Auxiliary Boiler Fuel Oil and Fire Protection Fuel Oil
2.3.3.6-1	October 11, 2002	December 19, 2002	Diesel Jacket Water
2.3.3.7-1	October 11, 2002	December 19, 2002	Diesel Starting Air
2.3.3.8-1	October 11, 2002	November 22, 2002	Instrument Air
2.3.3.8-2	October 11, 2002	November 22, 2002	Instrument Air
2.3.3.9-1	October 11, 2002	November 22, 2002	Nitrogen Gas
2.3.3.9-2	October 11, 2002	November 22, 2002	Nitrogen Gas
2.3.3.10-1	October 11, 2002	December 19, 2002	Containment Ventilation
2.3.3.10-2	October 11, 2002	December 19, 2002	Containment Ventilation
2.3.3.10-3	October 11, 2002	December 19, 2002	Containment Ventilation
2.3.3.11-1	October 11, 2002	December 19, 2002	Auxiliary Building Ventilation
2.3.3.12-1	October 11, 2002	December 19, 2002	Control Room HVAC and Toxic Gas Monitoring
2.3.3.13-1	October 11, 2002	December 19, 2002	Ventilating Air

2.3.3.14-1	October 11, 2002	November 22, 2002	Fire Protection
2.3.3.14-2	October 11, 2002	November 22, 2002 December 19, 2002	Fire Protection
2.3.3.14-3	October 11, 2002	December 19, 2002	Fire Protection
2.3.3.14-4	October 11, 2002	December 19, 2002	Fire Protection
2.3.3.15-1	October 11, 2002	November 22, 2002	Raw Water
2.3.3.15-2	October 11, 2002	November 22, 2002	Raw Water
2.3.3.16-1	October 11, 2002	November 22, 2002	Component Cooling
2.3.3.16-2	October 11, 2002	December 19, 2002	Component Cooling
2.3.3.16-3	October 11, 2002	November 22, 2002	Component Cooling
2.3.3.16-4	October 11, 2002	November 22, 2002	Component Cooling
2.3.3.16-5	October 11, 2002	November 22, 2002	Component Cooling
2.3.3.16-6	October 11, 2002	November 22, 2002	Component Cooling
2.3.3.16-7	October 11, 2002	November 22, 2002	Component Cooling
2.3.3.19-1	October 11, 2002	November 22, 2002	Primary Sampling
2.3.3.20-1	October 11, 2002	December 19, 2002	Radiation Monitoring - Mechanical
2.3.4-1	October 11, 2002	December 19, 2002	Steam and Power Conversion Systems
2.3.4.1-1	October 11, 2002	December 19, 2002	Feedwater
2.3.4.3-1	October 11, 2002	December 19, 2002	Main Steam and Turbine Steam Extraction
2.3.4.3-2	October 11, 2002	December 19, 2002	Main Steam and Turbine Steam Extraction
2.3.4.3-3	October 11, 2002	December 19, 2002	Main Steam and Turbine Steam Extraction
2.4.1-1	October 11, 2002	December 19, 2002	Containment
2.4.1-2	October 11, 2002	December 19, 2002	Containment
2.4.1-3	October 11, 2002	December 19, 2002	Containment

2.4.1-4	October 11, 2002	December 19, 2002	Containment
2.4.1-5	October 11, 2002	December 19, 2002	Containment
2.4.1-6	October 11, 2002	December 19, 2002	Containment
2.4.1-7	October 11, 2002	December 19, 2002	Containment
2.4.2-1	October 11, 2002	December 19, 2002	Structures
2.4.2.1-1	October 11, 2002	December 19, 2002	Auxiliary Building
2.4.2.2-1	October 11, 2002	December 12, 2002	Turbine Building and Service Building
2.4.2.3-1	October 11, 2002	December 19, 2002	Intake Structure
2.4.2.4-1	October 11, 2002	RETRACTED	Building Piles
2.4.2.5-1	October 11, 2002	December 19, 2002	Fuel Handling and Heavy Load Handling Equipment
2.4.2.5-2	October 11, 2002	December 19, 2002	Fuel Handling and Heavy Load Handling Equipment
2.4.2.5-3	October 11, 2002	December 12, 2002	Fuel Handling and Heavy Load Handling Equipment
2.4.2.6-1	October 11, 2002	December 19, 2002	Component Supports
2.4.2.7-1	October 11, 2002	December 19, 2002	Duct Banks
2.4.2.7-2	October 11, 2002	December 19, 2002	Duct Banks
2.4.2.7-3	October 11, 2002	December 19, 2002	Duct Banks
2.5-1	October 11, 2002	December 19, 2002	Electrical and Instrumentation & Controls
3.1-1	October 11, 2002	December 19, 2002	Reactor Systems
3.1-2	October 11, 2002	December 12, 2002	Reactor Systems
3.1.1-1	October 11, 2002	December 19, 2002	Reactor Systems
3.1.1-2	October 11, 2002	December 19, 2002	Reactor Systems
3.1.1-3	October 11, 2002	December 19, 2002	Reactor Systems
3.1.1-4	October 11, 2002	December 19, 2002	Reactor Systems

3.1.2-1	October 11, 2002	December 19, 2002	Reactor Systems
3.1.2-2	October 11, 2002	December 19, 2002	Reactor Systems
3.1.2-3	October 11, 2002	December 12, 2002	Reactor Systems
3.1.2-4	October 11, 2002	December 12, 2002	Reactor Systems
3.1.2-5	October 11, 2002	December 19, 2002	Reactor Systems
3.1.2-6	October 11, 2002	December 12, 2002	Reactor Systems
3.1.3-1	October 11, 2002	December 19, 2002	Reactor Systems
3.2-1	October 11, 2002	December 19, 2002	Engineered Safety Features Systems
3.2.1-1	October 11, 2002	December 19, 2002	Engineered Safety Features Systems
3.2.1-2	October 11, 2002	December 12, 2002	Engineered Safety Features Systems
3.2.1-3	October 11, 2002	December 19, 2002	Engineered Safety Features Systems
3.2.3-1	October 11, 2002	December 19, 2002	Engineered Safety Features Systems
3.2.3-2	October 11, 2002	December 19, 2002	Engineered Safety Features Systems
3.3-1	October 11, 2002	December 12, 2002	Auxiliary Systems
3.3-2	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.1-1	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.1-2	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.1-3	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.1-4	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.1-5	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.1-6	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.1-7	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.1-8	October 11, 2002	December 12, 2002	Auxiliary Systems
3.3.1-9	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.1-10	October 11, 2002	December 19, 2002	Auxiliary Systems

3.3.1-11	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.1-12	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.1-13	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.1-14	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.1-15	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.2-1	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.2-2	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.2-3	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.2-4	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.2-5	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.2-6	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.2-7	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.3-1	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.3-2	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.3-3	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.3-4	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.3-5	October 11, 2002	December 19, 2002	Auxiliary Systems
3.3.3-6	October 11, 2002	December 19, 2002	Auxiliary Systems
3.4-1	October 11, 2002	December 12, 2002	Steam and Power Conversion Systems
3.4-2	October 11, 2002	December 12, 2002	Steam and Power Conversion Systems
3.4.1-1	October 11, 2002	December 12, 2002	Steam and Power Conversion Systems
3.4.1-2	October 11, 2002	December 19, 2002	Steam and Power Conversion Systems
3.4.1-3	October 11, 2002	December 12, 2002	Steam and Power Conversion Systems
3.4.1-4	October 11, 2002	December 12, 2002	Steam and Power Conversion Systems

3.4.1-5	October 11, 2002	December 19, 2002	Steam and Power Conversion Systems
3.4.1-6	October 11, 2002	December 12, 2002	Steam and Power Conversion Systems
3.4.1-7	October 11, 2002	December 12, 2002	Steam and Power Conversion Systems
3.4.1-8	October 11, 2002	December 12, 2002	Steam and Power Conversion Systems
3.4.1-9	October 11, 2002	December 12, 2002	Steam and Power Conversion Systems
3.4.1-10	October 11, 2002	December 19, 2002	Steam and Power Conversion Systems
3.4.1-11	October 11, 2002	December 19, 2002	Steam and Power Conversion Systems
3.4.1-12	October 11, 2002	December 19, 2002	Steam and Power Conversion Systems
3.4.1-13	October 11, 2002	December 19, 2002	Steam and Power Conversion Systems
3.4.1-14	October 11, 2002	December 12, 2002	Steam and Power Conversion Systems
3.4.3-1	October 11, 2002	December 19, 2002	Steam and Power Conversion Systems
3.4.3-2	October 11, 2002	December 12, 2002	Steam and Power Conversion Systems
3.5-1	October 11, 2002	December 12, 2002	Structures
3.5-2	October 11, 2002	December 12, 2002	Structures
3.5.1-1	October 11, 2002	December 12, 2002	Structures
3.5.1-2	October 11, 2002	December 12, 2002	Structures
3.5.1-3	October 11, 2002	December 19, 2002	Structures
3.5.1-4	October 11, 2002	December 19, 2002	Structures
3.5.1-5	October 11, 2002	December 12, 2002	Structures
3.5.1-6	October 11, 2002	December 12, 2002	Structures
3.5.1-7	October 11, 2002	December 12, 2002	Structures

3.5.1-8	October 11, 2002	December 19, 2002	Structures
3.5.1-9	October 11, 2002	December 19, 2002	Structures
3.5.1-10	October 11, 2002	December 19, 2002	Structures
3.5.1-11	October 11, 2002	December 19, 2002	Structures
3.5.1-12	October 11, 2002	December 12, 2002	Structures
3.5.1-13	October 11, 2002	December 19, 2002	Structures
3.5.1-14	October 11, 2002	December 19, 2002	Structures
3.5.1-15	October 11, 2002	December 19, 2002	Structures
3.5.1-16	October 11, 2002	December 19, 2002	Structures
3.5.1-17	October 11, 2002	December 12, 2002	Structures
3.5.1-18	October 11, 2002	December 19, 2002	Structures
3.5.1-19	October 11, 2002	December 19, 2002	Structures
3.5.3-1	October 11, 2002	December 12, 2002	Structures
3.6-1	October 11, 2002	December 19, 2002	Electrical and I&C
4.1-1	October 11, 2002	December 12, 2002	Identification of Time-Limited Aging Analyses
4.2-1	October 11, 2002	December 19, 2002	Reactor Vessel Neutron Embrittlement
4.2-2	October 11, 2002	December 19, 2002	Reactor Vessel Neutron Embrittlement
4.3.1-1	October 11, 2002	December 19, 2002	Metal Fatigue
4.3.2-1	October 11, 2002	December 19, 2002	Metal Fatigue
4.3.2-2	October 11, 2002	December 12, 2002	Metal Fatigue
4.3.2-3	October 11, 2002	December 19, 2002	Metal Fatigue
4.3.4-1	October 11, 2002	December 12, 2002	Metal Fatigue
4.5-1	October 11, 2002	December 19, 2002	Concrete Containment Tendon Prestress

4.5-2	October 11, 2002	December 19, 2002	Concrete Containment Tendon Prestress
4.6-1	October 11, 2002	December 12, 2002	Containment Liner Plate and Penetration Sleeve Fatigue
4.7.1-1	October 11, 2002	December 19, 2002	Reactor Coolant Pump Flywheel Fatigue
4.7.2-1	October 11, 2002	December 19, 2002	Leak-Before-Break
B.1-1	October 11, 2002	December 19, 2002	Aging Management Programs
B.1-2	October 11, 2002	December 19, 2002	Aging Management Programs
B.1.1-1	October 11, 2002	December 19, 2002	Bolting Integrity Program
B.1.2-1	October 11, 2002	December 19, 2002	Chemistry Program
B.1.3-1	October 11, 2002	December 12, 2002 December 19, 2002	Containment Inservice Inspection Program
B.1.3-2	October 11, 2002	December 19, 2002	Containment Inservice Inspection Program
B.1.4-1	October 11, 2002	December 12, 2002	Containment Leak Rate Program
B.1.5-1	October 11, 2002	December 19, 2002	Flow-Accelerated Corrosion Program
B.1.7-1	October 11, 2002	December 19, 2002	Reactor Vessel Integrity Program
B.2.1-1	October 11, 2002	December 19, 2002	Boric Acid Corrosion Prevention Program
B.2.1-2	October 11, 2002	December 12, 2002	Boric Acid Corrosion Prevention Program
B.2.3-1	October 11, 2002	December 19, 2002	Diesel Fuel Monitoring and Storage Program

B.2.3-2	October 11, 2002	December 19, 2002	Diesel Fuel Monitoring and Storage Program
B.2.3-3	October 11, 2002	December 12, 2002	Diesel Fuel Monitoring and Storage Program
B.2.4-1	October 11, 2002	December 12, 2002	Fatigue Monitoring Program
B.2.4-2	October 11, 2002	December 19, 2002	Fatigue Monitoring Program
B.2.5-1	October 11, 2002	December 19, 2002	Fire Protection Program
B.2.5-2	October 11, 2002	December 12, 2002	Fire Protection Program
B.2.5-3	October 11, 2002	December 19, 2002	Fire Protection Program
B.2.5-4	October 11, 2002	December 19, 2002	Fire Protection Program
B.2.5-5	October 11, 2002	December 19, 2002	Fire Protection Program
B.2.7-1	October 11, 2002	December 19, 2002	Periodic Surveillance and Preventive Maintenance Program
B.2.7-2	October 11, 2002	December 19, 2002	Periodic Surveillance and Preventive Maintenance Program
B.2.8-1	October 11, 2002	December 19, 2002	Reactor Vessel Internals Inspection Program
B.2.9-1	October 11, 2002	December 19, 2002	Steam Generator Program
B.2.9-2	October 11, 2002	December 19, 2002	Steam Generator Program
B.3.1-1	October 11, 2002	December 19, 2002	Alloy 600 Program

B.3.2-1	October 11, 2002	December 12, 2002	Buried Surfaces External Corrosion Program
B.3.2-2	October 11, 2002	December 19, 2002	Buried Surfaces External Corrosion Program
B.3.3-1	October 11, 2002	December 19, 2002	General Corrosion of External Surfaces Program
B.3.3-2	October 11, 2002	December 19, 2002	General Corrosion of External Surfaces Program
B.3.3-3	October 11, 2002	December 12, 2002	General Corrosion of External Surfaces Program
B.3.3-4	October 11, 2002	December 12, 2002	General Corrosion of External Surfaces Program
B.3.3-5	October 11, 2002	December 19, 2002	General Corrosion of External Surfaces Program
B.3.3-6	October 11, 2002	December 19, 2002	General Corrosion of External Surfaces Program
B.3.4-1	October 11, 2002	December 19, 2002	Non-EQ Cable Aging Management Program
B.3.6-1	October 11, 2002	December 19, 2002	Selective Leaching Program
B.3.6-2	October 11, 2002	December 19, 2002	Selective Leaching Program

APPENDIX D

PRINCIPAL CONTRIBUTORS

LICENSE RENEWAL AND ENVIRONMENTAL IMPACTS PROGRAM

NAME	RESPONSIBILITY
Pao-Tsin Kuo	Branch Chief
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Thelma Davis	Clerical Support
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Melissa Jenkins	Administrative Support
Tomeka Terry	Technical Support
Jacqwan Walker	Technical Support
Hai-Boh Wang	Technical Support
Alicia Williamson	Technical Support

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David Cullison	Plant Systems Engineering
Barry Elliot	Materials Engineering
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Tom Farnholtz	Inspection Support
Ed Forrest	Plant Systems Engineering
Vincent Gaddy	Inspection Support
Greg Galletti	Quality Assurance
Amritpal Gill	Electrical Engineering
Joe Golla	Plant Systems Engineering
Jin Guo	Plant Systems Engineering
Gregory Hatchett	Plant Systems Engineering
Diane Jackson	Plant Systems Engineering
David Jeng	Civil Engineering
Steve Jones	Plant Systems Engineering
Cheryl Khan	Materials Engineering
Meena Khanna	Materials and Chemical Engineering
Yong Kim	Mechanical Engineering
Carol Lauron	Materials Engineering
Arnold Lee	Mechanical Engineering

Chang Li	Plant Systems Engineering
Renee Li	Mechanical Engineering
John Ma	Civil Engineering
Tom McLellan	Materials Engineering
James Medoff	Materials Engineering
James Melfi	Inspection Support
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Matthew Mitchell	Materials Engineering
Ray Mullikin	Inspection Support
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Jai Rajan	Mechanical Engineering
Muhammad Razzaque	Reactor Systems Engineering
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April Smith	Materials Engineering
Frank Talbot	Quality Assurance
Harold Walker	Plant Systems Engineering
Wayne Walker	Inspection Team Leader
Alan Wang	Inspection Support
Leonard Willoughby	Inspection Support